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Proposed Plan Amendment and Final Environmental Impact Statement/ Final Environmental Impact Report

for the

Ocotillo Wind Energy Facility

Volume 7 of 7

Appendix O (part 2) through Appendix R

Bureau of Land Management

County of Imperial

February 2012

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Appendix O, continued

Comment Letters on the Draft EIS/EIR

The comment letters are arranged in the order listed in Tables 5-1 and 5-2 of Chapter 5.

Federal Agencies

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Appendix O, continued

Comment Letters on the Draft EIS/EIR

Comment Letter P270

From: ladeekittee@aol.com
Sent: Monday, October 03, 2011 12:57 PM
To: Angelina Havens
Subject: Stop blocking inheritances with false claims

Public land, public energy...wind wheels along the wild not placed on top of lizards may not be so bad. Note who is for or against progress,note who makes false claims of involvement. ~ Maija from Detroit

P270-01

Comment Letter P271

From: Joan Leopold [joanleopold1@gmail.com]
Sent: Tuesday, October 04, 2011 9:29 AM
To: Angelina Havens; John Renison; Jack Terrazas; Gary Wyatt; Ray Castillo; conrad@theabf.org
Subject: Ocotillo Express Wind Farm

To Whom It May Concern:

I wish to express my opposition to the desert wind power development to be built near the Anza Borrego State Park. I believe this would cause irreparable damage to our desert. It would impact numerous desert species negatively and the plants and soils as well.

P271-01

I don't believe this development enhances the nearby communities. This kind of project needs to be built near the users of this power not in our desert. The creation of this project may provide short term employment but the damage to our environment will be everlasting.

Please do not approve this project!!!

Thank you!

Kind regards,

Joan Leopold

04 October 2011

Attention:
Mr. Cedric Perry, Project Manager
United States Bureau of Land Management
22835 Calle San Juan de Los Lagos
Moreno Valley, CA 92553

From:
Susan Hancock & Richard Orne
P.O. Box 674
Borrego Springs, CA 92004

Subject:
OCOTILLO EXPRESS WIND PROJECT

Mr. Cedric Perry:

We appreciate being given the opportunity to voice our thoughts on the proposed Ocotillo Express Wind Turbine Project, by the BLM and Pattern Energy.

We find ourselves extremely concerned that the Ocotillo Express Wind Project has been proposed on this public and protected desert location, with total disregard for the natural and *unique* botanical, culturally historical, geological and anthropological resources found nearby and yet to be discovered in this beautiful desert area.

P272-01

BLM has the job mandate to protect our public lands, and in this case, we believe your agency has failed us terribly. Under the California Desert Conservation Plan, BLM designated the area for *"Limited Use"*, meaning vehicles are restricted to existing trails thus preventing damage to the surrounding areas. This determination was finally accepted after *years* of public input and review. Now, we see a private proposal to destroy *13,000 acres* of our public lands, for the private industrial investment zone. This site will be desecrated forever, but so will hundreds of thousands of acres of surrounding lands with their natural desert qualities also destroyed, and also for forever.

P272-02

About 155 wild turbines are now proposed for this project. According to sources, it is estimated that 6-7% of all energy sent into a 500Kv power line such as the Sunrise Power Link, is *lost in transmission.* This means that 6% of all the energy generated by those wind turbines will escape and be *completely wasted.* The electrical energy generated, will be lost on the long transmission to San Diego. The valuable energy generated by nine wind turbines, built at huge expense, will be wasted, gone forever.

P272-03

How many *acres* will those **nine** turbines alone cover, and destroy? How many *generations* of steadily declining bird populations and other important species will they kill in their 30 year life span? **P272-03, cont.**

In addition, after reading the Wildlife Impacts Section of the Document, we considered the impacts to the desert bighorn sheep. During our review, we found it convenient that the USF&WS had just recently *undesignated* a huge swath of Critical Habitat in this region *and most notably*, just in time for the Ocotillo Express to be able to state that their project is (now) not within Critical Habitat. So much for our Endangered Species Act. **P272-04**

What of the golden eagles who use this desert site for food foraging? An average of sixty Golden Eagles are killed each year at the Altamont Pass Wind Generation site, near San Jose. *SIXTY*, six-oh, a year!! It takes 10-20% of *all* the Golden Eagle nests in CA to re-supply those sixty birds killed in just that one wind generator project! What of the CA Condors being restored in Northern Baja? One CA Condor was documented traveling into the US, as far as Cuyamaca and Anza-Borrego. What of the 16 burrowing owls, and the Western Mastiff Bats, both listed as BLM *Sensitive Species*? BLM should be **ashamed** of approving this environmental document for public release. **P272-05**

We would vote **against** building Ocotillo Express, and vote for putting the money and energy into rooftop solar power generation where it will be used---in the city.

We moved to this desert because we love it and appreciate the millions of years it took to create it. We never tire of the fight to protect it. Energy should be developed with consideration in the regions where it will be consumed, not hundreds of miles away and then wastefully transported into the big cities. This project is an insult to us and to the desert area we fight to protect. **P272-06**

Many generations of lives are in the balance here. Without sustaining the natural balance in these native areas, and by ignoring natural desert habitats, we threaten the **chain** of living beings that support *all* living things.

We hope you will **re-consider** approval of this mega-industrial complex which should never exist in this native desert area.

Sincerely,

Susan Hancock and Richard Orne
Fulltime residents of Borrego Springs, CA

Comment Letter P273

From: Deborah Alice Jones [mailto:luckyalice@sbcglobal.net]
Sent: Friday, October 07, 2011 12:37 AM
To: Perry, Cedric C
Cc: alice jones; Lee Scott
Subject: Wind Turbines Yucca Vslley

My husband, Lee Scott & I purchased a home at 1221 Kickapoo Trail in Yucca Valley. We looked for 2 years & it is our dream house. I think it is the closest home to these proposed wind turbines. Our realtor, Tony Cipolla @ Joshua Tree Realty, assured us that no one could ever build on BLM land.

We are so shocked that we were not told sooner. Our pristine desert would suffer. Also there are do many Native American petroglyphs there. Many beautiful birds would die

P273-01

Why can't this be done in Johnson valley or Wonder valley?

Please reconsider this drastic change. Could people voluntarily have these turbines?

Slice Xjones

Sent from my iPhone

October 6, 2011

To Whom It May Concern:

The bureau of Land Management has proposed a project that will destroy 12,000 acres of desert habitat and cultural artifacts. The 155 wind turbines proposed will damage wildlife in the Jacumba Mountains and Borrego Springs area. My main concern about this proposed project is that it will destroy the lives of wildlife species such as birds, bats, and most notably, the flat tailed horned lizard which is on the verge of being on the list of Endangered Species Act.

The importance of these wildlife animals is crucial to the environment. Many species in the area eat away the bacteria that infest in plants and agriculture. Bats, for example, eat away other species and bacteria that contaminate agricultural fields which make our crops safer to eat. Also, bats are attracted to vibration and the vibration caused by the turbines will eventually lead to them getting hit by the blades and dying along with many other birds.

P274-01

Yes, wind turbines don't produce greenhouse gasses and have a low level of pollution, but there are also alternative and cheaper ways to avoid pollution and produce high megawatts of electricity such as installing rooftop solar panels. Instead of wiping out a whole area filled with habitats, why not install wind turbines and solar panels in areas that are already disturbed or in areas that will have very little damage on wildlife animals.

However, the damages outweigh the benefits of wind turbines. It has negative effects on biodiversity and on environmental degradation. Also, the geographical distribution of the energy is very low and cities further away from the turbines don't get access to that energy.

P274-02

Over the years, the cost for making wind turbines has gone down significantly but that shouldn't be a good enough reason to destroy natural habitats of animals. Animals on our planet play a big role in the environment and it is morally and ethically wrong to kill those animals when there are many alternative and equally efficient ways to produce energy.

P274-03

Sincerely,

Akshay Khatri

From: Diana Palacios [mailto:dpalaci2@students.imperial.edu]
Sent: Thursday, October 06, 2011 8:34 PM
To: Perry, Cedric C; angelinahavens@co.imperial.ca.us
Subject: The Ocotillo Wind Energy Facility

Hi,

My name is Diana Palacios, I attend to Imperial Valley College and live in Holtville, C.A. The Ocotillo Wind Energy Facility is a good started for renewable energy and to also create new jobs. Jobs something that now a days a lot of people is wanting obtain. However there are some cons that will in further future have some consequences based on the Ocotillo Wind Energy Facility. This Facility is looking forward to construct about five miles West of Ocotillo, some 155 thirty story high windmills, and taking 15,000 acres of public land. It will eventually create many uncomfortable sounds while the construction to the residents of Ocotillo. An even at times delaying some traffic too. Not considering all the animals that live out there in the wildlife and that there homes will be destroyed just so that the Wind Energy Facility could be constructed. These projects eventually destroyed many of the animals wildlife's and have a relative high impact on them giving some of the residents to become overwhelm. For this reasons I will want vote against the Ocotillo Wind Energy Facility.

P275-01

Imperial Valley College Disclaimer:
This message was sent from an IVC student email account.

From: Robert Cavanaugh [mailto:osianfion@verizon.net]
Sent: Thursday, October 06, 2011 4:52 PM
To: Perry, Cedric C
Subject: Opposition to the proposed Ocotillo Wind Farm

Dear Mr. Perry,
I wish to comment on the proposed wind farm adjacent to the Anza-Borrego desert. I am a resident of Temecula and have visited the desert park and been overwhelmed by the atmosphere and uniqueness of the site. While I am a staunch proponent of alternative energy, this project should be re-examined. It is well known that wind farms do increase the background noise and will negatively impact the wildlife in the area. The landscape will also be changed forever, due to the road construction required for accessing the turbines.

P276-01

Anza-Borrego is a unique ecosystem, and should be preserved.

Sincerely,
Robert Cavanaugh
Temecula CA

From: Lilla Hangay [mailto:zolika@sbcglobal.net]
Sent: Thursday, October 06, 2011 10:03 PM
To: Perry, Cedric C; angelinahavens@co.imperial.ca.us
Cc: jackterrazas@co.imperial.ca.us
Subject: STOP Ocotillo Express Wind Project

Dear sir

Please stop the Ocotillo Express Wind project, please adopt the "no project alternative".
Jet another way to destroy nature, our beautiful parks, its habitats.
Give us - the people - at last a chance to comment further.

P277-01

Thank you.

Best, Lilla Hangay

The Ocotillo Express Wind Project

As a citizen born with natural rights and the protection of the 27 amendments that allow me to speak for all when I say I am against the "Ocotillo Express Wind Project." What's more the BLM deliberately prevented its own members of the public from speaking at scoping meetings for the project. I found this outrageous and inhumane.

P278-01

Everyone who will be affected by this project should have the right to speak up and be heard by the BLM and show that the citizens of Ocotillo are here. Not only is the BLM in a violation of citizen speaking rights at the meetings they held, but the devastation this project would cost at such a price that animals and people, but more importantly our earth has to pay.

Many endangered species such as the peninsular big horn sheep, and the flat-tailed horned lizard are listed already in the endangered species act, and if we let this project take into action this could be the end of these animals including the damages it would cause to the environment, the citizens close by to ocotillo and many other animal species such as the golden eagle, some known raptors, the LeConte's thrasher, burrowing owls, and other bird species at the brink of death.

P278-02

Along with these many tragic possibilities comes health risk to the people of Ocotillo from these proposed turbines which could cause deaths. It is sad to know that along with all those awful things that can occur, if this project goes under way you should really take a minute to think about. Do we really need more harm as it is, not only to Ocotillo, but to the planet and its environment itself? Is it worth the destruction of planet earth for just a mere bit more of energy that will only worsen the environment? I think not.

P278-03

-Sincerely Frank Tagaban

From: Divine, Anisa [mailto:AJDivine@IID.com]
Sent: Wednesday, October 05, 2011 4:58 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Attn: Cedric Perry - The Ocotillo Wind Project

Dear Mr. Perry,

I am writing from my IID email address, because I do not have a personal email account. I am expressing my personal opinion, which has nothing to do with IID.

I oppose the Ocotillo Wind Project for the following reasons:

1. Caliche layers will be disturbed changing rainfall infiltration and subsurface availability for perennial vegetation, difficult if not impossible for successful revegetation where caliche layer is near surface, and wildlife impacts.

2. Disturbing caliche will release carbon sequestered/stored since last ice age when more abundant rainfall supported more abundant vegetation. How much carbon will be released from caliche?

3. Removing vegetation and making roads in undisturbed areas will increase erosion and fungal spores that cause valley fever will get into air, entire County is a valley fever endemic area according to CDC.

4.Cutting in wide dirt roads across FEMA designated floodways in washes is not wise and may alter drainage patterns with down gradient impacts on way to Salton Sea.

The details:

Concerns about releases of carbon that has been sequestered in soils and as calcium carbonate in caliche layers that were formed during the last ice age and at a time when rainfall was more abundant and supported a denser cover and more abundant vegetation that supported the mega fauna for which there is now fossil evidence in the Anza Borrego State Park and nearby. There are very deep and exposed caliche deposits throughout the Yuha and area to north and west of Ocotillo. Research scientists at UC Riverside and USGS have expressed concerns about the amount of carbon that may be released if the desert soils and caliche layers are disturbed. Too many unknowns and too much research that needs to be done before putting in a road network and deep foundations for turbines in area crossing washes and cutting/dozing through caliche.

Cutting through caliche layers can be problematic in terms of rainfall infiltration patterns being changed and the impacts on desert vegetation, especially the larger perennials. On BLM restoration sites use of a backhoe or dozer to dig up the caliche layer, resulted in changed rainfall infiltration and die-off of 137 creosote bushes surrounding the "restored" site. Site was photographed by a USGS geologist as an example of the damage that can be done when working in an area with significant caliche (walking distance from houses in Ocotillo and so bad that BLM removed its desert restoration signs). **P279-01**

This leads to the conclusion that revegetation or reclamation in areas with significant caliche deposits is unlikely, and raises questions about changed rainfall infiltration and subsurface water for vegetation, both annual and perennial, both nearby and down gradient. Several scientists have questioned whether there is actually a net carbon reduction over the long term if relatively undisturbed soils are cleared of vegetation, and carved up for wide roads necessary to transport heavy equipment and turbine blades

.

Putting in wide dirt roads crossing FEMA designated floodways may significantly change drainage or run-off in the washes which at times have experienced three one-hundred year floods within a five-year **P279-02**

period. Much of Imperial Valley was under water following the hurricanes of 1976 and 1977, with the Ocotillo area being hit really hard. The 1976 storm took out the west-bound lanes of Interstate 8 and the railroad, in addition to taking out the center of Ocotillo. There was more flooding and large and deep standing water in the Ocotillo area in 1981, and last year 2 inches of rain fell in 1 hour, doing a lot of deep scouring, moving of rocks and boulders and turned dirt roads into rivers with whitecaps.

One science advisor PhD hydrogeologist with the Mojave National Park showed photos of the dust bowl of the 1930s with an auto piled with belongings and family headed west. Her comments, this is the future for the southwest, but the cars will be different, but where will the people go. Concern among scientists is that if the relatively undisturbed public lands are cleared for solar or cut with roads and wind turbines, that dust blowing off-site once the crust has been disturbed will increase and erosion will increase.

P279-02, cont.

In addition, all of Imperial County is an endemic area for the fungus that causes valley fever (according to the CDC) and the fungal spores reside in the upper inches of the undisturbed soil. Once the surface is disturbed the chances for human exposure increases. Apparently all it takes is a single spore to cause valley fever. So more dust, even if not visible means more potential for valley fever both in Imperial Valley and in AZ. NEPA documents have warned about the possibility of valley fever associated with the construction of the transmission line through the Yuha desert.

P279-03

Thank you for taking my input.

Best regards,

Anisa Divine

Anisa Divine, Ph.D.
1531 Ross Avenue #229
El Centro, California 92243

From: roland lajoie [mailto:rmljr1@yahoo.com]
Sent: Thursday, October 06, 2011 5:47 PM
To: Perry, Cedric C
Subject: Wind Farms in Anza-Berrago Desert State Park

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

ANZA-BORREGO Desert State Park

Mr Perry :

After spending a great amount of time in this DESERT this past winter with friends that have been going there for around forty plus years (40 +)and realizing that it is used by thousands of people it would be a shame for this area to become a WIND-FARM and force out thousands of people from a BEAUTIFUL PUBLIC recreational area . California should be ashamed of it-self as a State for the people . **P280-01**

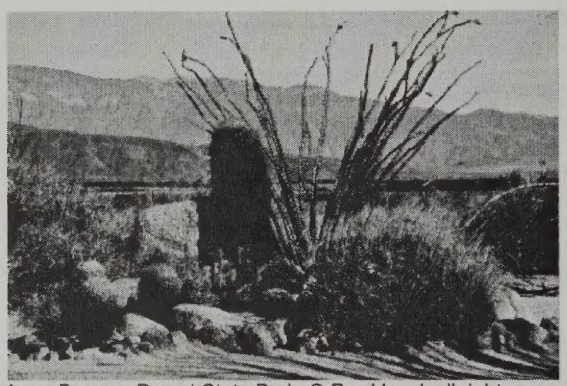
This would be a travesty and shameful on the State of California . We've traveled about three thousand miles to to enjoy this area this past winter and we are looking forward this coming Winter 2011/2012 to again enjoy this absolutely beautiful area of the STATE of CALIFORNIA , County of San Diego .

ROLAND & SUZANNE LAJOIE

49 Captain Besse RD.
South Yarmouth, Massachuetts 02664-2804

508-394-2011

Protecting California's Anza-Borrego Desert State Park is not as simple as it sounds. Occasionally issues arise that pull the attention away from the day-to-day work of supporting the Park, and require people to defend the space they have designated to be untouched, reports the Anza Borrego Foundation (ABF).
Ocotillo Express Wind Turbine Project



Anza-Borrego Desert State Park. © Rex Vogel, all rights reserved

The proposed Ocotillo Wind Energy Facility consists of the construction, operation, and maintenance of wind turbines and associated facilities to generate up to 465 mw of electrical energy directly adjacent to Anza-Borrego Desert State Park, within the vicinity of the community of Ocotillo. A proposed total of 155 wind turbines, which would power up to 140,000 homes—each up to 425 feet tall—and up to 42 miles of access roads would be located on 12,436 acres. The project would be located contiguous with the southwestern border of Anza-Borrego Desert State Park, straddling Highway S-2. P280-02

Potential Visual Impact

The Anza Borrego Foundation has created two images of how the proposed wind farm would appear (see below).

It's More than the Park Views that is Threatened

Impacts to natural resources of Anza-Borrego Desert State Park include:

- Disruption of wildlife corridors for desert bighorn sheep
- Adverse effects to golden eagles due to the birds striking the turbines
- Adverse impacts to burrowing owls, long-eared owls, Vaux's swift, peregrine falcons, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, American badgers, and several listed plant species P280-03
- Could cause significant deaths of bats due to the drop in air pressure causing internal hemorrhaging in the lungs as well as deaths from direct strikes
- Unavoidable impact to plants during construction and the introduction of invasive plant species
- Permanent scarring to the landscape leaving an "industrial" look to the area

Looking toward Ocotillo from Red Hill in Anza-Borrego Desert State Park. (Credit: theabf.org)

Impacts to cultural resources of Anza-Borrego Desert State Park include:

- Visual impacts to the newly designated Cultural Preserve at Piedras Grandes, just west of Ocotillo and its "sacred site" P280-04

- No adequate accounting for impacts to the multiple cultural resources of the area when viewed as a cultural landscape
- Cultural Studies not completed prior to assessing impacts

P280-04, cont.

Other potential impacts include:

- Substantial increase in noise levels from the operation of the turbines, especially at night in surrounding areas
- Impacts to air quality from truck traffic and from concrete batch plants
- Increased risk of wildfire hazards
- Loss of soil's ability to absorb carbon from scraping
- Degradation to the recreational and natural experience of Anza-Borrego Desert State Park by the sight of the turbines and associated facilities
- Loss of dark night skies
- Degradation of wilderness character of the several BLM wildernesses surrounding the proposed project

P280-05

View from Access Road to Mortero Palms in Anza-Borrego Desert State Park. (Credit: theabf.org)

Mr. Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553
cperry@blm.gov

RE: Ocotillo Express Wind Project: draft Environmental Impact Review / Environmental Impact Statement (EIR/EIS) comments

Am I reading this correctly? A gigantic, ill-conceived project in an irreplaceable desert habitat adjacent to Anza-Borrego Desert State Park, California's largest state park, designated as part of the world biosphere reserve. **Ocotillo Express Wind Project** would build 155 wind turbines up to 425 feet tall and up to 42 miles of access roads on 12,436 acres in the Jacumba Mountains.

And where will this energy be used? Far away, necessitating transmission lines which lose a significant amount of the energy. This project should not be allowed to mover forward to destroy the rural desert town of Ocotillo while there is an alternative to produce the needed kilowatts of energy more more reliably, cheaply and sustainably on rooftops and in parking lots and other distributed renewable energy sources AT or NEAR the cities where it will be used.

I have traveled through this area of desert only once, and it's beauty and importance for migration and foraging habitat for the Endangered **Peninsular Bighorn Sheep** is special to me. It is also next to a protected Management Area for the **Flat Tailed Horned Lizard** (proposed for listing under the Endangered Species Act), the Yuha Desert and its associated Area of Critical Environmental Concern, and several wilderness areas. However, it is not just protected species that I am concerned about. It is the very fabric of the desert and sustainable rural desert lifestyles that I also value. We must look at the larger picture and find a more responsible way of catering to our fast growing energy needs. We must produce energy in or near the place that it will be used. We must conserve, find new ways of doing things. That may be solar, wind, geothermal etc. Whatever works responsibly for that particular community. One day, we will look back and wonder why we had all those wires criss-crossing the country!

P281-01

The following impacts must be looked at carefully:

- *Destruction of vital habitat for the Endangered Peninsular bighorn sheep, and the flat-tailed horned lizard — a perennial candidate for listing under the Endangered Species Act.*
- *cumulative impacts on the above species from other energy, agricultural projects in the area and the many other human changes to the desert habitat.*
- *Consider the very serious threat of injury and death to golden eagles and other raptors known to live in the area, as well as the LeConte's thrasher, burrowing owls, several other sensitive birds species, and as many as twelve species of bats. AND consider the cumulative threat of this project with the treat to the same species from other energy projects nearby.*
- *Consider the full impacts on birds and all other creatures AND humans from the vibration and noise of the proposed windmills.*

P281-02

- *Forever alter the wild character of the southern parts of Anza-Borrego Desert State Park, destroying its recreational qualitie and the habitat connections that it provides.*
- *Desecrate ancient Native cultural sites in the the Yuha Desert cultural area, and interfere with the work of the soon-to-be-opened Imperial County Desert Museum.*
- *Turn the town of Ocotillo from a quiet, bucolic desert refuge to an industrial zone full of deafening noise 24 hours a day.*
- *Illegally alter the landscape surrounding the protected Juan Bautista de Anza National Historic Trail.*
- *Devastate those parts of Imperial County's economy that depend on tourism in the unspoiled desert*

P281-02, cont.

The Draft EIR/EIS is deficient because:

- *It does not include a "Distributed Generation" alternative*
- *Public comment was shortchanged due to a truncated "scoping" process*
- *It does not consider the cumulative impacts taking into consideration other proposed and likely projects nearby and the cumulative impacts on local rural residents.*

P281-03

I urge the BLM to adopt the "no project" alternative, in which the project would not be built.. In addition, the BLM must follow NEPA guidelines and allow the public to comment at scoping meetings. I strongly urge you to extend the public comment period by at least 30 days and hold additional public scoping meetings at which public statements would be allowed.

P281-04

Sincerely,

Jenny Wilder, Chair, Mojave Group, Sierra Club
19607 Sandy Ln, Apple Valley, Ca 92308
JensOasis@aol.com

CC: Angelina Havens, Imperial County Planning Department angelinahavens@co.imperial.ca.us,
Imperial County Board of Supervisors:
John Renison, District 1 Supervisor Email: johnrenison@co.imperial.ca.us
Jack Terrazas, District 2 Supervisor E-mail: jackterrazas@co.imperial.ca.us
Michael W. Kelley, District 3 Supervisor E-mail: michaelkelley@co.imperial.ca.us
Gary Wyatt, District 4 Supervisor E-mail: garywyatt@co.imperial.ca.us
Ray Castillo, District 5 Supervisor Email: raycastillo@co.imperial.ca.us

From: carmen ramirez [mailto:ramirezmcar@gmail.com]
Sent: Thursday, October 06, 2011 11:34 PM
To: Perry, Cedric C
Cc: angelinahavens@co.imperial.ca.us; johnrenison@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; michaelkelley@co.imperial.ca.us; garywyatt@co.imperial.ca.us; raycastillo@co.imperial.ca.us
Subject: Opposition to Ocotillo Express, LLC application to the BLM for a right-of-way (ROW) on public lands to construct a wind energy project

M. CARMEN RAMIREZ
Attorney at Law
2081 N. Oxnard Blvd., #150
Oxnard, CA 93036
(805) 216-7362
ramirezmcar@gmail.com

October 5, 2011

Via E-Mail to: cperry@blm.gov

Mr. Cedric Perry
Project Manager
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA, 92553

RE: **Ocotillo Express, LLC** application to the BLM for a right-of-way (ROW) on public lands to construct a wind energy project

Dear Mr. Perry,

I write you today with a despondent feeling that my words will not reach you and will also be sent into the wind.
But I must try…

Why must we destroy everything beautiful and natural for the sake of illusory "progress"? I have visited this area many times and even though I do not live close I consider it part of my heritage as a Californian and a citizen of this great country.

P282-01

Why can't we be smart as well as investing in our future energy supply? If we could put solar panels on commercial and residential buildings in already developed and urban areas we would not have to permit such a catastrophic actions as this project….

Once the desert is gone it is gone!!!

Please understand this and take steps to back away from this monstrosity. Your future descendents and mine will honor and thank you!

I believe that the proposed project will have a significant negative effect on the environment in the following, non-exclusive regards:

P282-01, cont.

There will be as substantially negative affect on the "**AESTHETICS of the environment. The answer is yes to all of the following questions: Will the project:**
(a) Have a substantial adverse effect on a scenic vista?
(b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?
(c) Substantially degrade the existing visual character or quality of the site and its surroundings
(d) Create a new source of substantial light or glare which would adversely affect day or nighttime views

P282-02

As to Air Quality, there will be potentially significant impacts on air quality. The eis states: that this following criteria as established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:
(a) Conflict with or obstruct implementation of the applicable air quality plan?
(b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?
(c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?
(d) Expose sensitive receptors to substantial pollutant concentrations?
(e) Create objectionable odors affecting a substantial number of people?

The answer is YES to all of these questions!

P282-03

Biological resources: will there will be a potentially significant impact on all of the following, would the project:

(a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?
(b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife

P282-04

Service?
(c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?
(d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery site. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?
(f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?
The answer is YES to all of the above.
Re Cultural Resources; Will the project:
(a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?
(b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?
(c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature

YES it will to all of these questions!

P282-04, cont.

Geology and soils: will the project:
(a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.
ii. Strong seismic groundshaking?
iii. Seismic-related ground failure, including liquefaction?
iv. Landslides?
(b) Result in substantial soil erosion or the loss of topsoil?
(c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?
(d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?
(e) Have soils incapable of adequately supporting the use

P282-05

of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater? YES TO ALL OF THE ABOVE!

P282-05, cont.

As to **GREENHOUSE GAS EMISSIONS**: Would the project:
(a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?
(b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? **YES!**

P282-06

Hazardous waste and activities?
Would the project result in a safety hazard for people residing or working in the project area? ***YES it would.***
(h) Expose people or structures to a significant risk of loss, injury,or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are
intermixed with wildlands? ***Yes it would***!

P282-07

HYDROLOGY AND WATER QUALITY. Would the project:
(a) Violate any water quality standards or waste discharge requirements?
(c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on site or off site?
(d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on or off-site?
(f) Otherwise substantially degrade water quality?
(g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?
(h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?
(i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?
(j) Inundation by seiche, tsunami, or mudflow?
Yes!!!!

P282-08

NOISE. Would the project:
(a) Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance or applicable standards of other agencies?
(b) Exposure of persons to or generation of, excessive groundborne vibration or groundborne noise levels?

P282-09

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?
(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?
(f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

P282-09, cont.

TRANSPORTATION/TRAFFIC - Would the project:
(a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?
(b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?
(c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?
(d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
(e) Result in inadequate emergency access?
(f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

P282-10

YES it would!

And so much more…. These are the points I would like to make:

The project would:
- Devastate vital habitat for the Endangered Peninsular bighorn sheep, and the flat-tailed horned lizard – a perennial candidate for listing under the Endangered Species Act.
- Add significantly to the cumulative impact on the above species from other energy and agricultural projects in the area.
- Pose a serious threat of injury and death to golden eagles and other raptors known to live in the area, as well as the LeConte's thrasher, burrowing owls, several other sensitive birds species, and as many as twelve species of bats.

P282-11

- Forever alter the wild character of the southern parts of Anza-Borrego Desert State Park, destroying its recreational qualities.
- Desecrate ancient Native cultural sites in the the Yuha Desert cultural area, and interfere with the work of the soon-to-be-opened Imperial County Desert Museum.
- Turn the town of Ocotillo from a quiet, bucolic desert refuge to an industrial zone full of deafening noise 24 hours a day.
- Illegally alter the landscape surrounding the protected Juan Bautista de Anza National Historic Trail.
- Devastate those parts of Imperial County's economy that depend on tourism in the unspoiled desert

P282-11, cont.

Furthermore, the Draft EIR/EIS is deficient because:
- It does not include a Distributed Generation alternative
- Public comment was shortchanged due to a truncated scoping process

P282-12

I Urge THE BLM to:
- **Adopt *the no project alternative***
- Extend the public comment period by at least 30 days
- Hold additional public scoping meetings at which public statements would be allowed.

P282-13

I beg you to defend our precious desert and our common heritage, the magnificent and irreplaceable and fragile California desert! You will be able to sleep at night and your children and descendants will be proud of what you have done if you chose to protect our lands.

P282-14

Thank you,

Sincerely,

Maria Carmen Ramirez
(805) 485-8026

Copies to:

info@theabf.org
Angelina Havens at the Imperial County Planning Department
angelinahavens@co.imperial.caus,
Imperial County Board of Supervisors:
John Renison
District 1 Supervisor
Email: johnrenison@co.imperial.ca.us
Jack Terrazas
District 2 Supervisor E-mail: jackterrazas@co.imperial.ca.us

Michael W. Kelley
District 3 Supervisor
E-mail: michaelkelley@co.imperial.ca.us
Gary Wyatt
District 4 Supervisor
E-mail: garywyatt@co.imperial.ca.us
Ray Castillo
District 5 Supervisor
raycastillo@co.imperial.ca.us

Comment Letter P283

From: Jared Fuller [mailto:jgillenfuller@yahoo.com]
Sent: Thursday, October 06, 2011 3:07 PM
To: Perry, Cedric C
Subject: Ococtillo Express Wind Energy

This project should be greatly reduced in size or not built at all. The location the project would be built contains valuable resources which should be conserved. These include habitat for threatened and endangered species such as flat-tailed horned lizard and Peninsular bighorn sheep. The project would harm bird and bat species. The visual and recreational resources of this area and neighboring Anza-Borrego Desert State Park would be greatly impacted. Also, archaeological and cultural resources would be damaged. At a minimum, the portions of this project with the highest concentration of cultural resources, those which contain the most valuable habitat for sensitive animals and plants, and locations within 1 to 2 miles of the state park boundary should not be approved for development. **P283-01**

In addition, because of the size of the project and concerns over the number of resources impacted, the comment period should be extended. **P283-02**

Thank you,
Jared G. Fuller
Provo, UT

Comment Letter P283

From: Jared Fuller [mailto:jgillenfuller@yahoo.com]
Sent: Thursday, October 06, 2011 3:11 PM
To: Perry, Cedric C
Subject: Ocotillo Express Wind Energy comment

The Ocotillo Express Wind project should be greatly reduced in size or not built at all. The location the project would be built contains valuable resources which should be conserved. These include habitat for threatened and endangered species such as flat-tailed horned lizard and Peninsular bighorn sheep. The project would harm bird and bat species. The visual and recreational resources of this area and neighboring Anza-Borrego Desert State Park would be greatly impacted. Also, archaeological and cultural resources would be damaged. At a minimum, the portions of this project with the highest concentration of cultural resources, those which contain the most valuable habitat for sensitive animals and plants, and locations within 1 to 2 miles of the state park boundary should not be approved for development.
In addition, because of the size of the project and concerns over the number of resources impacted, the comment period should be extended.

Thank you,
Jared Fuller
Provo, UT

From: David Andreoli [mailto:david.andreoli4100@gmail.com]
Sent: Tuesday, August 30, 2011 4:38 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Wind Project comments

I would like to express my opinion for the Ocotillo Wind Project. First, I would like to say that I live in San Diego, not Ocotillo, but have been coming to the desert for over 20 years to enjoy the open areas for recreation. I do agree that the wind farm will change the desert, the look, the feel, the 'free open spaces', however this project is needed.

If you look at the area prior to 1900, the desert was a different place then as well. There was no major highway, no major cities [Ocotillo was established in 1907] and no power lines, solar plants or wind farms. People make progress and there is a cost for progress.

The only other option to this endeavor is to stop progress and live like we did 100 years ago [no more new communities, shopping malls, manufacturing plants, farms, air conditioners, TVs, computers, phones, cars, etc, etc.]. Since people want there homes, malls, TVs, etc, etc, then we [the people] need power. The options for power are limited and this is a clean viable, renewable solution. **P284-01**

I would like to have my cake and eat it too. Have unlimited power and be able to enjoy the desert landscape undisturbed, but this is not realistic. As for the power generation options, [nuclear, solar, wind or fossil fuel], this leaves the most area accessible to the public, and is one of the safest and cleanest.

I will miss the undisturbed view, however I do support the plan.

David Andreoli
10642 Amantha Ave
San Diego, CA 92126

Comment Letter P285

From: Michael Peterson [mailto:mjpete9999@gmail.com]
Sent: Friday, September 02, 2011 12:22 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Wind Energy Project

After seeing the maps in the EIR of the proposed wind farm location, it reminds me of the Stephen King novels and movies...all of which include some entity engulfing the city or town. Maybe, if you opted to build the windfarm on the western side only (not surrounding the town of Ocotillo), you will probably not have as much opposition. Just something to think about.

P285-01

From: Daren R. Sefcik [mailto:dsefcik@sefcik.com]
Sent: Monday, August 29, 2011 9:13 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Wind Energy Project

I am adamantly opposed to the construction of the Ocotillo Wind Energy Project.

I attended the August 25th meeting in Ocotillo and am not sure I understand what the purpose was. All I saw was a very nervous BLM representative and several others from Pattern Energy basically saying "here is what we are going to build, please let us know what you think (in writing ONLY) and we will be sure to put it in our big document, thank you very much".

How is it that the public was not allowed to speak or comment in person at that meeting?? It is our land and we don't want the wind farm built. Little by little the very few remaining open, natural space we have left is being slowly taken away and destroyed. Every one of the people who represented Pattern and the BLM knew the project was just plain wrong unless you were one of the people benefiting financially from it and don't ever visit the desert or happen to actually live there. You could see it their body language and vocal responses. **P286-01**

I can't imagine how any of them even have a conscious.

Please consider extending the deadline for comments and allow a genuine, honest and open pubic meeting where the community can speak their concerns and have some honest representation from Pattern and the BLM who can respond to our concerns. **P286-02**

Thank you,
Daren Sefcik

Visual landscape ruined - Not needed due to reduction in electricity usage not mandated - Too close to residential community - Electricity rates will increase - The bureaucracy is pushing this project without listening to people - The wind turbine generators will be 448' tall, equal to a 44 story building - Better technology for renewable wind energy is expected in the near future. - Our money is being paid to wind energy developers in the form of grant money to enable them to profit - The project will be located on our land managed by our BLM **P286-03**

From: Greg Smith [mailto:insure@smithkandal.com]
Sent: Friday, August 26, 2011 2:34 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@co.imperial.ca.gov
Subject: Ocotillo Wind Energy Facility DEIS/DEIR Comments

I am writing in support of the proposed wind energy project in Ocotillo.

USA needs energy independence, and this project is one of the first steps toward that goal.

Pattern Energy presents a world-class, state-of-the-art wind energy farm for your consideration. The facilities are designed to mitigate every imaginable environmental impact including radar for flocks of migrating birds, biologists to monitor bighorn sheep and flat-tailed lizards, underground cabling to minimize visual impacts, and special care to site the turbines to cut down on noise pollution and "shadow flicker."

Considering the amount of effort to design the project to minimize environmental impacts, I am confident that Pattern Energy will also operate their project in a responsible manner.

P287-01

The payoff to the community is huge. Imperial County gets a substantial boost to its property tax base. Several hundred jobs are created during construction, and several tens of high-paying technical jobs remain during the operation of the wind energy farm.

In other communities, Pattern Energy is a major community supporter. In our community they have already spent tens of thousands of dollars to keep Westside School open and to support the many needs of their students. Pattern Energy is a good and responsible corporate citizen.

Sincerely,

Greg Smith
Smith-Kandal Ins & RE
P.O. Box 5/510 W. Main Street
Brawley, CA 92227
Phone 760-344-2212
Fax 760-344-3383
insure@smithkandal.com

From: mjorgensen@cableusa.com [mailto:mjorgensen@cableusa.com]
Sent: Friday, August 26, 2011 3:54 PM
To: Raml, Teresa A; BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Express "Public Meeting"

Teri Raml:

About 60-70 other folks and I attended a BLM meeting last night in Ocotillo to discuss the public's views on the DEIS of the proposed Ocotillo Express Wind Energy Project at the southern boundary of Anza-Borrego Desert State Park. As the retired Superintendent of Anza-Borrego and one who has studied the desert bighorn sheep since 1967, I was interested in presenting testimony at last night's meeting.

The public was shocked and disappointed to discover upon the opening of the meeting that this was actually an "Open House", and not a public meeting. A lot of folks travelled a lot of miles to present their opinions at this important stage of the process, and a lot of folks left the meeting in disappointment and anger. It appeared the BLM representatives and folks from Pattern Energy "dodged the bullet" last night, and it gave the clear impression they were not really interested in hearing the public's opposition to this ill-conceived energy proposal on 13,000 acres of our public land. I drove 160 miles round trip from Borrego Springs and I know many folks drove much further to attend this meeting. The word around the room was simply "disgust". **P288-01**

We all know we can submit our opinions in writing before the October deadline, which most of us were planning to do anyway . To hold a meeting to "explain the DEIS document" was a complete waste of our time and yours. We can read the document on-line, or by hard-copy or CD and we don't really need to drive 160 miles to have someone explain it to us.

I wanted you to know that I, and many others from the public were very disappointed in how the meeting was presented, and disappointed by the impression given us by Pattern Energy and the BLM. Everyone was kind, professional, and appeared well informed, but they obviously were not inclined to listen to public opinion. I consider the entire evening a total waste of time and gas.

Sincerely,

Mark C. Jorgensen, Borrego Springs, CA

Comment Letter P289

From: bndrbill@aol.com [mailto:bndrbill@aol.com]
Sent: Wednesday, August 24, 2011 9:22 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: I'm really upset about the proposed windmill farm.

I've been camping off S2 just north of Ocotillo and south of the park boundary since 1960. It's a beautiful area full of wildlife and better flowers than Borrego.

First the ag mine messed up the mountain, then the tower was put in with the beacon on it, then the trailer to take wind readings and find birds on radar.

P289-01

It's just awful what's happening to our desert. We always leave it cleaner than we found it. It's the way to the old railroad station and Goat Canyon where a lot of hikers like to go.

I really hate to see this BLM land ruined just when my five grandsons are beginning to enjoy camping.

Bill Howell
Santee, Ca.

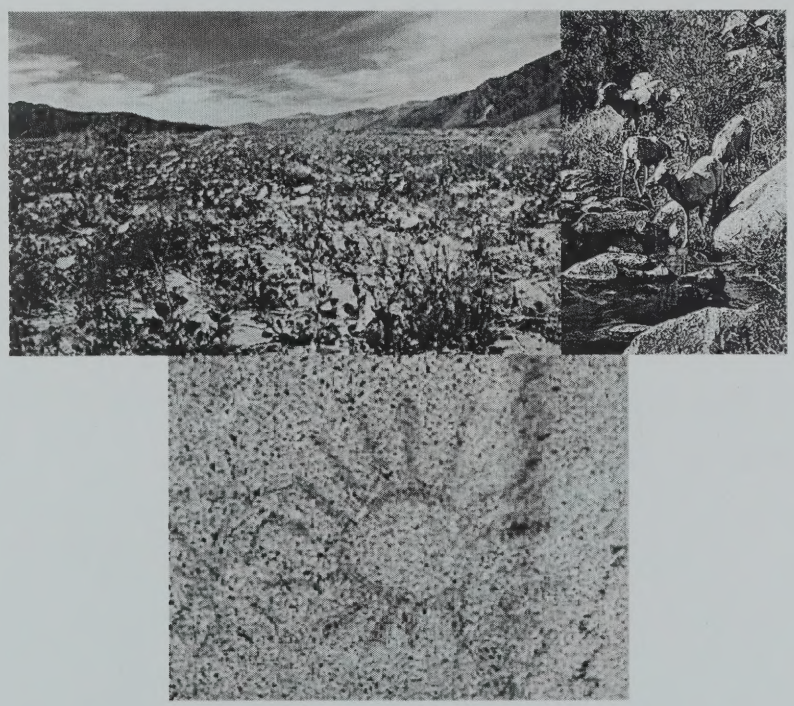
Perry, Cedric C

From: Abe Perlstein <ap3dguy@hotmail.com>
Sent: Tuesday, October 04, 2011 11:58 PM
To: Perry, Cedric C
Subject: NO Industrial Wind Farm for Anza Borrego

Mr. Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553
cperry@blm.gov

Dear Mr. Perry,

Anza Borrego State Park is a magical wonderland of infinite beauty and rare habitat. It should be a place of reverence.



As great as wind energy is, the U.S. Bureau of Land Management will be committing an atrocity next to this spectacular setting by planning to allow a massive wind farm in this precious desert treasure. Do you not understand the astonishing beauty, cultural and natural value of Anza Borrego? Reject this horrible project. It is totally inappropriate for this location.
Anza Borrego should remain place of nature appreciation, not a display case for an industrial wind farm. Please deny this project.

P290-01

Yours Truly,

Abram Perlstein
Los Osos, CA.

Perry, Cedric C

From: Bonnie McClees <bonniemcclees@yahoo.com>
Sent: Tuesday, October 04, 2011 8:50 PM
To: Perry, Cedric C
Subject: Proposed Wind Farm near A-B Desert State Park

Dear Mr. Perry,

As a former resident of Fontana and now a retired snowbird from Washington State, I have been enjoying the dark skies and quiet beauty of the Anza-Borrego Desert State Park for several years now. The idea of a windfarm in the Ocotillo area is a real shock to me, as the look of it and its impact on the wilderness area and the animals that live on the desert is quite simply out of place and detrimental to the peace of Nature I have learned to cherish there. And then there are the gorgeous dark skies that invite us to bring along our big 'scope that opens up views of the glories of the universe. Do you realize how rare it is to find skies of such magnificent quality as there are in the Borrego Springs and surrounding desert areas? There are so many wonderful and hard-to-duplicate treasures there - I am sure I cannot name them all. But I want to register my feelings of dismay at the thought that man's greed and selfishness could put much of that special beauty at risk I do hope the decision makers of Imperial County will decide to vote against this project going ahead.

P291-01

Cordially,
Bonnie L. McClees, CPA (Ret.)

Comment Letter P292

Perry, Cedric C

From: David Wimpfheimer <calnaturalist@earthlink.net>
Sent: Tuesday, October 04, 2011 5:26 PM
To: Perry, Cedric C
Subject: Ocotillo Wind Energy Facility

Dear Sirs,

I am writing to express my opposition to the the proposed Ocotillo Wind Energy Facility.

I have traveled in Anza Borrego State Park and adjacent lands numerous times. I also have looked at birds, mammals and other animals in the desert lands between Borrego Springs and the Salton Sea.

I oppose the proposed Ocotillo Wind Energy Facility for the following reasons.

Wildlife corridors, especially for desert bighorn sheep will be disrupted.

The turbines will have adverse effects to golden eagles.

P292-01

And other species such as burrowing owls, long-eared owls, Vaux's swift, peregrine falcons, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes and American badgers will also experience negative impacts.

Construction of the facility will lead to the introduction of invasive plant species.

Scarring of the landscape due to construction methods will last for decades.

An increase in noise levels from the operation of the turbines and a decrease in air quality are other negative impacts that will be experienced due to the operation of the proposed facility.

Please let me know the schedule for approval or disapproval of the project.

Thank you,

David Wimpfheimer

Comment Letter P293

RECEIVED
BUREAU OF LAND MGMT
11 SEP 30 AM 11 SEP 30
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

September 28, 2011

To whom it may concern:

I am writing in regard to the proposed Ocotillo Wind Energy Facility. I live in Borrego Springs and realize we need to develop renewable energy generation. However, **there are better ways to accomplish this**.

The Ocotillo Wind Energy Facility is not the way to do it. **Local rooftop and local distributed renewable energy generation** could easily power the 140,000 homes that this project is slated to power. Adopt the no-project alternative and protect 12,000 acres of intact desert habitat from destruction for private profit on a project that will be de-commissioned in 30 years! If this project goes through, there will be irreparable damage to the landscape.

P293-01

Concerned citizen and voter,

James Roller

Cc State Clearinghouse

Comment Letter P294

RECEIVED
BUREAU OF LAND MGMT
11 SEP 30 PM 4:09
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

Walter Joseph LUKINA
79-665 Star Flower Trail
LaQuinta, CA. 92253 4227
Phone 760 345 1408
Fax same - must be present when
dlukina@verizon.net

Mr. Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

September 29, 2011

Dear Mr. Perry:

I am a volunteer VP-Land Acquisitions for Anza-Borrego Foundation (partner with the Anza- orrego Desert State Park) and have been involved with purchasing land within the Park to make the Park whole for 18 years.

There is a need to continue to preserve the areas in and around the Park because of the tranquility many may seek in our current environment with all the gatchis, electronic, mechanical etc. This Park has it all!

My husband and I object to the proposed Ocotillo Wind Energy Facility. P294-01

For over 3 years Anza-Borrego Foundation and a score of many interested persons fought the "Sunrise Powerlink" which SDG&E planned to install and now it appears a similar negative problem has reared its ugly head!

My husband has been checking into solutions with respect to energy and he strongly feels in a about five to ten years, the need for energy will be acquired through scientific knowledge and there will be no need to destroy the land and views we all enjoy.

This project is not needed! To satisfy the requirements for some people, local rooftops and local distributed renewable energy generation is capable of powering 135,000 homes just as well without obstructing the view of our precious wilderness lands. Please understand in a few years what is proposed now will be totally obsolete and along with it destruction of our precious desert just because the greed of a few people. Take the time and visit our Park and you will truly see the light! P294-02

We do not support this Project and hope you will make a wise decision that will be recorded in "history".

Sincerely,

Walter J. Lukina

Delores Lukina VP-Acqusitions

FAX- State Clearinghouse 916 323 3018

Comment Letter P295

RECEIVED
BUREAU OF LAND MGMT
11 OCT -4 PM 3:41
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

October 2, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

SUBJECT: Proposed Ocotillo Wind Energy Facility

Dear Mr. Perry,

The Anza-Borrego Foundation (ABF), with its membership of 1,800 households is concerned about the proposed Ocotillo Wind Energy Facility that is sited directly adjacent to Anza-Borrego Desert State Park (ABDSP). ABF is a nonprofit corporation with a mission to support ABDSP. While ABF supports the development of renewable energy sources, such as wind and solar, we advocate for distributed generation, the concept that this energy should be generated closer to the population centers that will consume it. P295-01

This 12,000 acre development would mar the view shed of Anza-Borrego Desert State Park from many overlooks that are popular with hikers in the park. And the famed experience of the desert, the silence, the darkness, and wide vistas would be forever changed in lands that directly border wilderness designated areas.

There would also be devastating impacts to biological resources. The highly endangered Peninsular Big Horn sheep now live in and migrate through that area and this huge development can only impact in negative ways. Bird strikes with eagles, hawks and owls, not to mention other birds and bats could be significant. Many ground dwelling species will be threatened as well including lizards, and snakes, burrowing owls. P295-02

We are also concerned that the draft EIS does not meet NEPA requirements. It does not appear to consider a full range of alternatives, including distributed generation. There is also not a "no-project" alternative. This must be an option if impacts are considered to be too disastrous. P295-03

ABF is opposed to this project, in any form, adjacent to ABDSP. We request that you do not approve this project.

Sincerely,

James H. Smith
Board Member, Anza Borrego Foundation

Judith Ramirez
35481 Great Southern Overland Stage Route of 1849 • Julian, CA 92036

October 2, 2011

RECEIVED
BUREAU OF LAND MGMT.
11 OCT -4 PM 3:40
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Dear Mr. Perry,

I am writing to express my strong opposition to the Ocotillo Express Wind Energy Project. This mega project threatens the fragmentation and destruction of over 23 square miles of public land adjacent to Anza-Borrego State Park in the Sonoran Desert of California. The swath of land -- as big as the city of San Diego -- is a beautiful desert vista ringed by mountains near the small town of Ocotillo, but the project would etch miles of wide roads into the desert and build over 150 wind turbines that are equal in height to 30-story skyscrapers requiring tons of cement and steel. In addition it would negatively impact the natural and cultural resources of the Anza-Borreco Desert State Park (ABDSP). P296-01

Impacts to Natural Resources of ABDSP:

1. Disruption of wildlife corridors for desert bighorn sheep.
2. Adverse effects to golden eagles due to the birds striking the turbines.
3. Adverse impacts to burrowing owls, long-eared owls, Vaux's swift, peregrine falcons, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, American badgers, and several listed plant species.
4. Could cause significant deaths of bats due to the drop in air pressure causing internal hemorrhaging in the lungs as well as deaths from direct strikes.
5. Unavoidable impact to plants during construction and the introduction of invasive plant species.
6. Permanent scarring to the landscape leaving an "industrial" look to the area.

P296-02

Impacts to Cultural Resources of ABDSP:

1. Visual impacts to the newly designated Cultural Preserve at Piedras Grandes, just west of Ocotillo and its "sacred site."
2. No adequate accounting for impacts to the multiple cultural resources of the area when viewed as a cultural landscape.
3. Cultural Studies not completed prior to assessing impacts.

P296-03

Other Potential Impacts

1. Substantial increase in noise levels from the operation of the turbines, especially at night in surrounding areas.
2. Impacts to air quality from truck traffic and from concrete batch plants.
3. Increased risk of wildfire hazards.
4. Loss of soil's ability to absorb carbon from scraping.
5. Degradation to the recreational and natural experience of ABDSP by the sight

P296-04

of the turbines and associated facilities.
6. Loss of dark night skies.
7. Degradation of wilderness character of the several BLM wildernesses surrounding the proposed project.

P296-04, cont.

The draft EIS (Environmental Impact Study) does not meet NEPA requirements because it *lacks a full range of alternatives,* namely, the alternative of producing renewable energy on rooftops in the cities where the energy is used. The BLM should adopt a "no-project" alternative. The BLM is mandated to consider viable alternatives that could meet the "need" for the project that lie outside of lands within their jurisdiction.

P296-05

Indeed, this project is not needed. Local rooftop and local distributed renewable energy generation could power the 140,000 homes that this project is slated to power. This project is more about profit for San Diego Gas and Electric (SDG&E) than it is energy production. The Banning Wind Farm has only produced 15% of the energy projected when it was built.

P296-06

Adopt the no-project alternative and protect 12,000 acres of intact desert habitat from destruction for private profit on a project that will be de-commissioned in 30 years!

Sincerely,

Judith A. Ramírez

Judith A. Ramírez

Comment Letter P297

Briana Ross
PO Box 1561
Borrego Springs, CA 92004

October 3, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

RECEIVED
BUREAU OF LAND MGMT.
11 OCT -4 PM 3:40
CALIF. DESERT DISTRICT
MORENO VALLEY, CA.

SUBJECT: Proposed Ocotillo Wind Energy Facility

Dear Mr. Perry,

I would like to express my strong opposition to the Ocotillo Wind Energy Facility. The effects to the natural habitat, cultural resources and environment greatly out weigh any benefits from the construction of this facility. While I support the development of renewable energy sources, such as wind and solar, I advocate for distributed generation, the concept that this energy should be generated closer to the population centers that will consume it. P297-01

This 12,000 acre development would mar the view shed of Anza-Borrego Desert State Park. And the famed experience of the desert, the silence, the darkness, and wide vistas would be forever changed in lands that directly border wilderness designated areas. P297-02

There would also be devastating impacts to biological resources. The highly endangered Peninsular Bighorn sheep now live in and migrate through that area and this huge development can only impact in negative ways. Bird strikes with eagles, hawks and owls, not to mention other birds and bats could be significant. Many ground-dwelling species will be threatened including lizards, and snakes, burrowing owls. P297-03

It is my understanding that the draft EIS does not meet NEPA requirements because it lacks a full range of alternatives, namely, the alternative of producing renewable energy on rooftops in the cities where the energy is used. The BLM is mandated to consider viable alternatives that could meet the need for the project that lie outside of lands within their jurisdiction. I urge the BLM to adopt the no-project alternative and protect 12,000 acres of intact desert habitat from destruction for private profit on a project that will be de-commissioned in 30 years! If this project goes through, there will be irreparable damage to the landscape. P297-04

I am opposed to this project, in any form, adjacent to ABDSP. I request that you do not approve this project.

Sincerely,

Briana Ross

September 29, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

RECEIVED
BUREAU OF LAND MGMT.
11 OCT -4 PM 3:39
CALIF. DESERT DISTRICT
MORENO VALLEY, CA.

Dear Sir:

Re: Ocotillo Express Wind Turbine Project

This impacts the Natural Resources of Anza-Borrego Desert State Park (ABDSP).

1. Disruption of wildlife corridors for desert bighorn sheep.
2. Adverse effects to golden eagles due to the birds striking the turbines.
3. Adverse impacts to burrowing owls, long-eared owls, Vaux's swift, peregrine falcons, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, American badgers, and several listed plant species.
4. Could cause significant deaths of bats due to the drop in air pressure causing internal hemorrhaging in the lungs as well as deaths from direct strikes.
5. Unavoidable impact to plants during construction and the introduction of invasive plant species.
6. Permanent scarring to the landscape leaving an "industrial" look to the area.

P298-01

This project is not needed. Local rooftop and local distributed renewable energy generation could power the 140,000 homes that this project is slated to power. **Adopt the no-project alternative and protect 12,000 acres of intact desert habitat from destruction for private profit on a project that will be de-commissioned in 30 years!** If this project goes through, there will be irreparable damage to the landscape.

P298-02

We urge you to go for roof top solar power rather than these wind turbines.

Sincerely,

Richard Wagner
Jane Wagner

Richard and Jane Wagner
P O Box 2471
Borrego Springs, CA 92004

Comment Letter P299

RECEIVED
BUREAU OF LAND MGMT
11 OCT -4 PM 3:39
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

200 Childs Rd, Basking Ridge, NJ 07920

Sept 29, 2011

Mr. Cedric Perry
California Desert District
Office,
Bureau of Land Management

Dear Mr. Perry,

I am writing to you because I have received word that it is proposed to construct the 'Ocotillo Wind Farm' adjacent to the border of the Anza-Borrego Desert State Park.

The Anza-Borrego State Park means a lot to us, as does the surrounding area. It exists as a part of America which remains unspoiled. We have been visitors to the park for the last two years and are planning to return in March, 2012. We travel to the park for its pristine views and its peacefulness. P299-01

I am in my mid-sixties now and have seen our part of New Jersey changed from farms and villages to part of the metropolitan conurbation.

Please, please adopt the 'no project' option. Please save a jewel in the State of California.

Very sincerely,
Michael Paxton

Perry, Cedric C

From: Don Endicott <dlejr@yahoo.com>
Sent: Tuesday, October 04, 2011 10:00 PM
To: Perry, Cedric C
Subject: Requesting opposition to Ocotillo Express Wind Project

Dear Mr. Perry,
I am writing to you this evening to solicit your opposition of the proposed Ocotillo Express Wind Project. As a long-time resident of San Diego County and regular visitor to the southern part of Anza Borrego Desert State Park and BLM administered lands to its immediate south, I ask that alternative, green energy production means, such as roof top solar panels, be considered.

P300-01

I serve as a volunteer California Archaeological Site Steward, have been a volunteer participant for the annual Bighorn Sheep Count for the past two decades, and am a volunteer supporting the Wildlife Research Institute's long running Golden Eagle population studies. I have hiked and camped in this area for over 40 years, climbed most of its summits (e.g. Carrizo Mountain, Jacumba Peak) and explored many of its canyons and side canyons on both sides of the S2 corridor.

Aside from the visual impacts of multiple windmills in this scenic desert setting, there are potential harmful impacts on wildlife of the area, including Peninsular Bighorn Sheep that move between the west side of the Ocotillo plain (Jacumba Mountains) to the east side to bear their young (Carrizo Mountain). Undoubtedly adding a multitude of structures as large and imposing as electrical generation windmills will have some impact on the willingness and ability of these sheep to continue using their traditional lambing grounds.

P300-02

In support of WRI, I have helped tag and outfit Golden Eagle pre-fledglings with radio and satellite transmitters. Last year I helped locate and eventually recovered the body of a radio equipped adult Golden Eagle grounded near Joshua Tree after having its wings badly clipped by windmill blades in Banning Pass. It had starved to death, one of many, many migratory and resident raptors that have been impacted by windmills in their flight corridors. Further expansion of windmills to the Ocotillo area could well produce comparable effects.

I have not often taken the time to write to Government officials on this kind of issue and, indeed, have favored alternatives to fossil fuel consumption. However, in reviewing literature associated with the Ocotillo Express Wind Project, I feel there are reasonable alternatives that should be considered.

P300-03

Thank you for your time.

Respectfully,
Don Endicott, San Diego

Comment Letter P301

Perry, Cedric C

From: dotter7@comcast.net
Sent: Wednesday, October 05, 2011 8:34 AM
To: Perry, Cedric C
Subject: No Wind Farm

Dear Mr. Perry,
Please do not allow a wind farm to be built adjacent to Anza-Borrego Desert State Park.
Along with thousands, I beg you to reconsider such a devastating endeavor.
Thank you.
Dorothy Weisheit
Monterey, California

P301-01

Comment Letter P302

Perry, Cedric C

From: Dr Jackson Underwood <drjackson.underwood@gmail.com>
Sent: Tuesday, October 04, 2011 5:10 PM
To: Perry, Cedric C
Subject: Interested Party Comments, Ocotillo Express Project
Attachments: Observer Comments to BLM.docx

Dear Mr. Perry,

Attached are some interested party comments on the Ocotillo Express Project located near the community of Ocotillo in western Imperial County.

Thank you for considering these comments.

Sincerely,

Dr Jackson Underwood
Consulting Archaeologist, Retired.

Comment Letter P302

4 October 2011

Cedric Perry, Project Manager,
22835 Calle San Juan de Dos Lagos,
Moreno Valley, CA 92553

Regarding: Interested Party Comments for the
Ocotillo Express Project, Ocotillo, Imperial County, California

Dear Mr. Perry,

For most of the Ocotillo Express Archaeological Project, I was co-principal investigator, along with Dr. Mike Baksh. I retired in mid-August. Now I would like to register a few comments as an Interested Party. I have with no current connection to the project.

I began working in applied archaeology or heritage resource management in 1978 and continued until mid-August of this year. During that time I worked on or ran perhaps 50 large archaeological projects and maybe 100 small ones. Over that time as a consulting archaeologist, I have never encountered a project proponent that has been as helpful and interested in preserving heritage resources as Pattern Energy. They have cheerfully supported the efforts of the archaeologists and have poured a huge amount of resources into the historic preservation effort.

- They have completely redesigned their green energy project and also made minor adjustments over a half dozen times to avoid all significant heritage resource sites.
- While the project directly impacts less than 200 acres of permanent and 400 temporary acres, they have sponsored the survey of about 12,000 acres. I believe this is about 4,000 acres more than the BLM originally required.
- The archaeological survey has expended in excess of 30,000 archaeologist hours and identified and very thoroughly recorded almost 400 sites in this effort.
- While BLM did not require Native American monitors, Pattern Energy sponsored a very thorough and well-funded monitoring program. Tierra Environmental, on behalf of Pattern Energy, diligently tried to have a monitor on every survey crew. When Tierra was unable to find qualified Native Americans to monitor, they were attacked by Indians for not having enough monitors. When they hired additional monitors regardless of qualifications to meet their demands, Tierra was attacked by Indians for hiring unqualified monitors.
- As far as I know, the Native American community and the BLM have never expressed thanks to Pattern Energy for providing the extensive monitoring program, which amounted to hundreds of good paying work hours per month for more than a year.
- As far as I know, the BLM has never expressed thanks to Pattern Energy for their flexibility and cheerful cooperation in avoiding heritage resources in their effort to provide additional green energy for America and green jobs for Americans.

P302-01

In addition, I must say I have scientific reservations about the BLM native American consultation process. In social science, we typically select a representative sample of a community when we want to understand their needs, desires, values, etc. Of course, over the last half century, a huge literature has evolved dealing with sampling, interview techniques, questionnaire design, statistics, validity, and so on. I have to respectfully ask why the BLM has chosen to ignore science with regard to sampling Native American views. In a scientific approach, the researcher can statistically demonstrate and measure the representativeness of his/her sample. In contrast, while the BLM has extensive and thoughtful records of Native American concerns and comments expressed by a few outspoken Indians, these are clearly not a representative sample of their respective bands or tribes.

P302-02

The current process also exacerbates tensions surrounding proposed projects by treating the loudest critics as if they were somehow spokespersons of their bands or tribes. Some of the most vocal Native American critics of the Ocotillo Express project are not even enrolled members of any tribe or band. As you know, some of these public meetings end up feeling like a lynching. At the end of the often discordant consultation process, we still have no valid idea of the needs, desires, and values of the various Indian bands and tribes. In my view, this is rather disrespectful to all, but especially the Indians who deserve better. It is also a waste of scarce BLM resources and talent.

Similarly, I must express concerns about the nation-to-nation consultation process. While there are BLM archaeologists in most or all field offices, these are often low-level employees with little or no training in cultural anthropology or diplomacy. Yet they and other untrained staff are called upon to conduct nation-to-nation consultations with tribes. Thus the lack of qualified staff often turns a well-meaning effort into a diplomatic problem for the BLM. May I respectfully suggest that you have highly qualified cultural anthropologist lead nation-to-nation interactions with tribes.

P302-03

In conclusion, allow me to thank the BLM for considering these comments on the Ocotillo Express Project. I appreciate how difficult it is to strike a reasonable balance among many competing interests in the management of public lands. The BLM has a very challenging mission.

Thank you for your service to the country.

Sincerely

Jackson Underwood

Dr. Jackson Underwood
Consulting Archaeologist (Retired)

Perry, Cedric C

From: Brown Fred <fbcarmel@comcast.net>
Sent: Wednesday, October 05, 2011 8:13 AM
To: Perry, Cedric C
Subject: Wind Farm Anza Borrego

Wind Farms are an un-economical, poorly constructed blight on the landscape and a disaster for the bird population.

The cost of the installation and maintenance does not justify the benefits of the energy generated by these colossal eye-sores. Just look at the facts and the ones in place.

P303-01

Please do not fall into the big money trap perpetuated by the large companies promoting these disasters.

Fred Brown
Carmel, CA

Perry, Cedric C

From: Fred Wollman <fwollman@ingfp.com>
Sent: Tuesday, October 04, 2011 4:49 PM
To: raycastillo@co.imperial.ca.us; garywyatt@co.imperial.ca.us; michaelkelley@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; johnrenison@co.imperial.ca.us; angelinahavens@co.imperial.ca.us
Cc: Perry, Cedric C; conrad@theabf.org
Subject: Ocotillo Express Wind Project

October 4, 2011
Imperial County Planning Dept, Angelina Havens

Imperial County Supervisor, John Renison; Jack Terrazas, Michael Kelley; Gary Wyatt; and Ray Castillo

Copies to: State Clearinghouse 916-323-3018; BLM, Cedrick Perry; Anza Borrego Foundation

REGARDING: Ocotillo Express Wind Project

To Whom It May Concern:

I find it very troubling the speed of which this matter is being handled and the lack of time for public comment. This 12,000 acre project deserves greater scrutiny by all parties that will be affected for decades to come.

Our beautiful Southern California Desert will be changed forever with a project of this magnitude. Yes, our energy needs are important and we need to plan for clean energy alternatives to fossil fuels. However, this is a very diverse and important area in terms of biology (big-horned sheep, golden eagles and other raptors); culture (Yuha Desert cultural area and the Imperial County Desert Museum); and people (Anza Borrego State Park and areas of Imperial County) that depend upon the unspoiled desert . **P304-01**

It appears the EIR/EIS is deficient because it does not include a "distribution generation" alternative and public comment was shortchanged due to truncation of the scoping process. **P304-02**

Our desert is a valuable asset and should be preserved.

Thank you for your attention to this matter. I would encourage all parties to expand the public comment period by 30 to 60 days and hold addition additional meetings to receive public comment. **P304-03**

Fred Wollman
30655 Persimmon Lane

Valley Center, CA 92082
760-737-2246

Comment Letter P305

Perry, Cedric C

From: herbert petrillo <herbiep1@yahoo.com>
Sent: Tuesday, October 04, 2011 10:21 PM
To: Perry, Cedric C

wind farms can destroy the beauty of an area... please do not allow more beauty to be desecrated by mans attempts to rectify his destruction of nature... would you want to see your garden destoyed by insects? the earth is a garden, lets not let techno-insects destroy the beauty that we have been bestowed with... **P305-01**

Comment Letter P306

Perry, Cedric C

From: John Barth <john@ausafari.com>
Sent: Wednesday, October 05, 2011 8:01 AM
To: Perry, Cedric C
Subject: Anza-Borrego

Dear Mr. Perry,

Please deny the proposed wind farm project being considered for Anza Borrego State Park. I live in Texas and continually see these wind farms as the inefficient eye sores that they are. Not only do they ruin the landscape, but none of the wind farms here in Texas even operate at a 50% efficiency. They are not economically viable without the government grants, and the ones here on the Texas coast are already experiencing massive mechanical failures. P306-01

Please don't allow them to fuck up another beautiful state park with these ridiculous wind turbines.

Sincerely,
John Barth

Adventure Unlimited, Inc.
Tel: 361-852-0537
Email: safaris@trip.net
Web: www.BigBuffalo.com
Skype: johnbarth1

Comment Letter P307

Perry, Cedric C

From: jonvick2@aol.com
Sent: Tuesday, October 04, 2011 5:15 PM
To: Perry, Cedric C
Cc: angelinahavens@co.imperial.caus; johnrenison@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; michaelkelley@co.imperial.ca.us; garywyatt@co.imperial.ca.us; raycastillo@co.imperial.ca.us
Subject: Fwd: Ocotillo Wind comments

Mr. Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Dear Mr. Perry,

People from all over the world visit the Anza- Borrego Desert to enjoy the flora and fauna that live in this distinctly unique and fragile environment. A wind farm will destroy much of this irreplaceable natural resource and kill many animals and birds that we are trying to protect. **P307-01**

The project would:
- Devastate vital habitat for the Endangered Peninsular bighorn sheep, and the flat-tailed horned lizard — a perennial candidate for listing under the Endangered Species Act.
- Add significantly to the cumulative impact on the above species from other energy and agricultural projects in the area.
- Pose a serious threat of injury and death to golden eagles and other raptors known to live in the area, as well as the LeConte's thrasher, burrowing owls, several other sensitive birds species, and as many as twelve species of bats.
- Forever alter the wild character of the southern parts of Anza-Borrego Desert State Park, destroying its recreational qualities.
- Desecrate ancient Native cultural sites in the the Yuha Desert cultural area, and interfere with the work of the soon-to-be-opened Imperial County Desert Museum.
- Turn the town of Ocotillo from a quiet, bucolic desert refuge to an industrial zone full of deafening noise 24 hours a day.
- Illegally alter the landscape surrounding the protected Juan Bautista de Anza National Historic Trail.
- Devastate those parts of Imperial County's economy that depend on tourism in the unspoiled desert

P307-02

The Draft EIR/EIS is deficient because:
- It does not include a "Distributed Generation" alternative
- Public comment was shortchanged due to a truncated "scoping" process

P307-03

We urge THE BLM to:
- Adopt the "no project" alternative
- Extend the public comment period by at least 30 days
- Hold additional public scoping meetings at which public statements would be allowed.

P307-04

Thank you.

Sincerely,

Jon Vick
Member, Valley Center Planning Group
13678 McNally Road
Valley Center, CA 92082
Tel 760-751-0250

Comment Letter P308

Linda Tandle
3400 Richmond Parkway, Apt. 1208, Richmond, CA 94806
linda.tandle@gmail.org * 619-885-7806

October 5, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553
cperry@blm.gov

FAXed copy to the State Clearinghouse: 916-323-3018

Dear Mr. Perry,

As the former executive director and manager of the Anza-Borrego Foundation (ABF) for 16 years, I am shocked that there would be any consideration whatsoever of locating the Ocotillo Wind Energy Facility with its proposed 155 wind turbines on property contiguous to Anza-Borrego Desert State Park (ABDSP). For those 16 years and as it does today, ABF supports and defends the pristine beauty of ABDSP as one of the most unique desert environments in the world. To sully that beauty with wind turbines is unconscionable. P308-01

I urge you to adopt the "no project" alternative to protect this important desert habitat from the devastating impacts of a "forest" of turbines, each 425 feet tall, and up to 42 miles of access roads carving up 12,436 acres of desert habitat. The draft EIR/EIS is incomplete because it does not include an alternative for production of renewable energy at point of use in cities. P308-02

Impacts to ABDSP are numerous: disruption of wildlife corridors for the federally endangered desert bighorn sheep, loss of birds due to striking the turbines, disturbance and loss of habitat for our more "grounded" animal friends, including flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, and American badgers. Bats could suffer internal lung hemorrhaging due to the drop in air pressure near the turbines. As well, construction will unavoidably introduce invasive plant species, and cause permanent scarring to the landscape leaving a repugnant "industrial" look to the area. P308-03

One impact of great concern to me, having witnessed the damage caused by un-regulated off highway vehicle use in the desert, concerns the destruction of the microbiotic desert crust so essential to healthy soils and desert ecosystems. It has been shown that areas stripped of these crusts are vulnerable to erosion, flooding, deflation, dust storms, invasions of exotic weeds that thrive on disturbed soils, and/or chemical impoverishment due to loss of organic material and precipitation of minerals. It takes decades, or longer, for these crusts to reform. P308-04

Other impacts include a substantial increase in noise levels from the operation of the turbines—especially noticeable at night, impacts to air quality from the construction itself, degradation of the recreational and natural experience for visitors to ABDSP, loss of dark night skies, and loss of the wilderness character of the several BLM-designated wildernesses surrounding the proposed project.

For those of us who know first-hand the beauty of the desert and understand its fragility, it is difficult to fathom why so many others see deserts as vast wastelands suitable only for projects such as this one. Once again, I urge BLM to adopt the ***"no project"*** alternative. P308-05

Sincerely,

Linda Tandle

Linda Tandle, Former Executive Director, Anza-Borrego Foundation

Perry, Cedric C

From: Mack Ray <MRay@americanbank.com>
Sent: Wednesday, October 05, 2011 7:16 AM
To: Perry, Cedric C
Subject: Anza Borrego wind project

Mr. Perry

As a citizen, tax payer, businessman and logical person I am opposed to the wind generation project at the above location

I am in fact opposed to wind generation projects knowing they cost 4-5 times as much as conventional sources such as natural gas – We probably have enough natural gas in the USA to last 50 years which is plenty of time to develop a make sense project out of wind if in fact it ever will make logical economic sense. **P309-01**

I don't think it is right to put wind farms in on ugly useless land much less a place such as Anza Borrego area.

Please consider this request not to allow such a project to happen.

thanks,

Mack Ray
104 Townhouse Lane
Corpus Christi, Texas 78412

Perry, Cedric C

From:	Mike Dusharme <mikedusharme@gmail.com>
Sent:	Wednesday, October 05, 2011 7:09 AM
To:	Perry, Cedric C
Subject:	Anza-Borrego wind farm project

Dear Mr. Perry,

The public benefits of the spiritual beauty and cultural insights provided by the Anza-Borrego natural areas are timeless, irreplaceable and far outweigh the short term benefits of the wind farm project. **P310-01**

Please act to deny the wind farm energy project currently under consideration. Thank you.

Mike Dusharme

PYRAMID CONSTRUCTION AND AGGREGATES, INC.

General Engineering Contractor
State Contractor Lic. No. 866533

The Ocotillo Wind Project proposed by Pattern Energy offers many positive benefits to the Imperial Valley.

Imperial County and its residents have for many years wanted industry that provide jobs and economic opportunity while being environmentally conscious.

Pattern has addressed every environmental and self interest concern presented to them. This is in addition to the very long list of requirements of the permitting process.

This project will create jobs and economic opportunity for the Imperial Valley. Pattern has made sincere efforts to use local companies and local work force when possible.

Our company, Pyramid Construction and Aggregates, Inc., will be used to provide aggregate materials and infrastructure improvements. This project will help us maintain our current work force plus, depending on construction schedules, add an additional 30 employees.

Our companies' work force comes from Imperial Valley. We employ people from nearly every Imperial Valley city. Jobs are very important to the well being of our local residents and their families. With the development of the Ocotillo Wind Project, the economic benefits equal jobs for our community. A more prosperous community will help our Valley continue to be a good place to work and raise our families. As a lifelong Imperial Valley resident with pioneer great grandparents, my interest is for the advancement of quality of life for residents of Imperial Valley, with jobs, economic opportunity and a prosperous community.

Supporting Pattern Energy in their Ocotillo Wind Project is also supporting Imperial Valley Business and the Imperial Valley work force.

Many other long term positive benefits will come from the Ocotillo Wind Project. It is our sincere desire this project will soon receive approval to construct.

P311-01

Thank you,

Daryl Dickerson

Daryl Dickerson
Pyramid Construction and Aggregates, Inc.

839 Dogwood Road • Heber, CA • 92249 • Tel (760) 337-5839 Fax (760) 337-5993

From: Eric Mustonen [mailto:mustonenwood@cox.net]
Sent: Wednesday, October 05, 2011 11:39 AM
To: Perry, Cedric C; Angelina Havens; John Renison; Jack Terrazas; Michael W. Kelley; Gary Wyatt; Ray Castillo; Conrad Kramer
Subject: Opposition to the "Ocotillo Express Wind Project"

We are writing to strongly oppose the "Ocotillo Express Wind Project" which is proposed to be constructed in an area that is of great environmental value. This is an area that we are very familiar with having enjoyed hiking and camping there on numerous occasions over the past forty years. Lying between the Peninsular Range of mountains to the west and the Coyote mountains to the east, this project would severely and negatively impact an area of great and unique scenic beauty and environmental value. Certainly, an area in which many people enjoy outdoor activities would be forever lost for those purposes. This impact would not stop at the Imperial County line but would also negatively affect the southern portion of Anza Borrego Desert State Park in that area. The project would also have an enormously negative impact on the town of Ocotillo and could make living there very unpleasant, if not intolerable.

P312-01

In addition to recreation, this area also is an important resource for numerous species of desert plants and animals. This project will hinder, and perhaps stop altogether, the travel of the Peninsular Bighorn Sheep, an endangered species, between the Peninsular mountains and the Coyote mountains further decreasing their already shrinking habitat. The construction of numerous large towers, and ongoing maintenance, will disastrously impact vegetation, soils, smaller non-migrating animals, and native American cultural features. The windmills would be a significant hazard to birds and bats. The project area is located within a seismically active area and is actually on top of the Elsinore fault zone, one of the most active fault zones in Southern California.

P312-02

P312-03

We do appreciate the necessity for the generation of power from renewable sources but we strongly believe that this project is planned for the wrong area. It will have a profound and long lasting negative impact on an area of unique beauty and recreational opportunities, as well as on the plant and animal species found there. This negative impact will continue indefinitely into the future and some aspects of it will be irreversible.

P312-04

We implore you to stop the "Ocotillo Express Wind Project".

Eric Mustonen
Amelia G. Wood

mustonenwood@cox.net

619-223-5926

756 Amiford Dr.
San Diego, CA 92107

From: Rich, Mark [mailto:MRich@prmech.com]
Sent: Wednesday, October 05, 2011 1:30 PM
To: Perry, Cedric C
Cc: conrad@theabf.org; angelinahavens@co.imperial.caus; johnrenison@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; michaelkelley@co.imperial.ca.us
Subject: PROJECT EIS

To all,
My name is Mark Rich. I'm nothing special, just a hard working family man who lives in Lakeside, Ca. That being said, I'm writing this letter in regards to what sounds like quite a large project that would take place in the Anza Borrego desert.
My family and I are avid campers, hikers,bikers etc. and just love the outdoors. We have created so many priceless, precious memories in this beautiful part of God's country. Hikes up Palm Canyon, viewing big horn sheep, night time s'mores at the campfire....etc. etc.
With the utmost respect, Im' pleading with you to please reconsider any type of construction that would compromise this beautiful area, it's resourse or it's wild life. I understand construction...that is what I do for a living, but if we "plant" wind generating equipment throughout this area, it will be ruined and the beauty gone.
What a shame this would be.
I had to let you know how I feel, because if I didn't I would forever regret it...if this indeed were to happen.
Please know that some things are more important than technology and it's development. This is one of those circumstances.
Sincerely and respectfully,
Mark Rich.
619-571-1578.

P313-01

From: Joe [mailto:qualt@cox.net]
Sent: Wednesday, October 05, 2011 10:59 AM
To: Perry, Cedric C
Subject: Opposition to Pattern Energy wind turbines

October 5, 2011

Cedric Perry
BLM Project Manager
California Desert District Office

Dear Mr. Perry,

This letter is to urge you to deny the approval of the massive wind turbine project that would be constructed in the area around Ocotillo, California 92259.

There are many reasons this project needs to stopped; these are only a few of them:

- Large Wind farms are rarely, if ever, a cost effective source of reliable electrical energy. As with this project the American citizens will need to subsidize Pattern Energy with not only our tax money but also with our public land, since the project cannot financially sustain itself on its own merit. This amounts to another hidden, back door tax on every one of us. The more wind farm projects that are approved the more US taxpayers are being suckered. The only alternative to this projected fraud is to eliminate it before it occurs. **P314-01**

- The location of the wind turbines, for the most part, will be on sensitive public land managed by the BLM. For many years the BLM has categorized this as a sensitive area that needs to be managed and protected. As I am sure you know, currently this area can only be accessed by street licensed vehicles traversing specific trails, and all vehicles must stay on these trails. Anyone not adhering to the specific marked trails is subject to fines and possibly even imprisonment. If this project is approved, the area will by necessity become tore up with construction and underground cable trenching. If that is allowed to occur, having previously categorizing this area as "sensitive" will be shown to have been done without merit. Precedent will then have been set to challenge all other BLM areas currently categorized as sensitive or needing protection. **P314-02**

- The wind turbines will be a visual blight to anyone entering, or leaving, the western side of Imperial county. This blight will only become worse as the turbines become older and obsolete. **P314-03**

- There is now enough evidence to show that a wind farm near a residential area can and will cause health problems to citizens in the nearby community. **P314-04**

- A wind farm near a residential community will drastically lower the property values and this will lower the property tax revenues going to the local government. **P314-05**

Therefore I urge you to oppose this project, on BLM managed land, near Ocotillo, California.

Sincerely,

Joseph Asciutto
953 Molitar Rd.
P.O. Box 15
Ocotillo, CA 92259

Comment Letter P315

From: Camille Rothenburg [mailto:crothen1@san.rr.com]
Sent: Wednesday, October 05, 2011 1:07 PM
To: Perry, Cedric C
Cc: johnrenison@co.imperial.ca.us; raycastillo@co.imperial.ca.us; garywyatt@co.imperial.ca.us; michaelkelley@co.imperial.ca.us; jackterrazas@co.imperial.ca.us
Subject: Octillo Express Wind Project

I want to express my huge concern regarding the wind mills in the desert. I believe they will be very detrimental to our desert - particularly the birds. This is new and we do not know what long term effects it will have on our desert ecology. More study is needed.
Please do not rush into this project. Thank you. Tom & Camille Rothenburg, Borrego Springs residents.

P315-01

Comment Letter P316

Lyle Brecht

P.O. Box 401 Borrego Springs, CA 92004-0401 LBrecht@gmail.com

TEL (760) 767-3620 **CELL** (410) 963-8680

October 5, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

RE: OCOTILLO WIND FARM "NO PROJECT" ALTERNATIVE

Dear Mr. Perry:

I am a resident of Borrego Springs and an elected official as Director of the Borrego Water District. I have served as an environmental policy advisor for a variety of federal agencies and as a business development consultant for both smaller and Fortune 500 size companies. I am a member of the Anza Borrego Foundation (ABF). My educational background is graduate degrees in applied ecology and business. In the past I have been asked to formally review EIR/EIS studies involving the siting of nuclear power plants, drilling for oil in the Georges Bank, as well as assessing capital allocation projects for the federal executive branch, and a variety of public utility and large industrial enterprises. However, today, I write you as a concerned citizen only, not in any official capacity.

P316-01

My concern with the Ocotillo Express Wind Turbine Project as presently proposed is its location in Ocotillo Wells adjacent to the Anza Borrego Desert State Park (ABDSP). I am uncertain that an adequate assessment of the potential economic impacts to the ABDSP and to the region have been considered in the location of the project contiguous to the ABDSP. In the research literature, it appears that changes to the edges of natural biomes often produce the greatest economic impacts. This affect was originally pointed out by the Spanish ecologist, Ramon Margalef in the 1970's.

What that means in practice is that to preserve the ongoing economic value of an ecological perserve, one must protect its edges from encroachment. That is one reason why the emphasis now to preserve Yellowstone and the Grand Tetons National Parks is to preserve the much larger Greater Yellowstone Ecosystem. That is why the work of ABF is so important - to help protect the edges of the ABDSP from encroachment. What happens at the edges will often overdetermine the future economic condition of the protected ecosystem.

P316-02

But protecting ecosystems has a cost. Questions include: how much and who pays? My understanding is that with approximately 500,000 visitors a year to the ABDSP in recent years, this conservatively generates about $50,000,000 in revenue to the region. But, this $50M is essentially an annuity that gives a conservative monetized asset value to the ABDSP of approximately $1.67 billion (using a discount rate of 3%). Any responsible EIR/EIS would need to include a Probabilistic Risk Assessment (PRA) of the potential cost to the region of the Ocotillo Wind Farm estimate of PRA impact on the value of the ABDSP. Otherwise, although the Ocotillo Wind Farm may look appealing as a stand-alone project, it may be an economic looser.

signed: Lyle Brecht

From: Darren Smith [mailto:darren@smithkandal.com]
Sent: Wednesday, October 05, 2011 1:42 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@co.imperial.ca.us
Subject: Ocotillo Wind Energy Facility DEIS/DEIR Comments

I am writing in support of the proposed wind energy project in Ocotillo.

USA needs energy independence, and this project is one of the first steps toward that goal.

Pattern Energy presents a world-class, state-of-the-art wind energy farm for your consideration. The facilities are designed to mitigate every imaginable environmental impact including radar for flocks of migrating birds, biologist to monitor bighorn sheep and flat-tailed lizards, underground cabling to minimize visual impacts, and special care to site the turbines to cut down on noise pollution and "shadow flicker."

P317-01

Considering the amount of effort to design the project to minimize environmental impacts, I am confident that Pattern Energy will also operate their project in a responsible manner.

The payoff to the community is huge. Imperial County gets a substantial boost to its property tax base. Several hundred jobs are created during construction, and several more of high-paying technical jobs remain during the operation of the wind energy farm.

In other communities, Pattern Energy is a major community supporter. In our community they have already spent tens of thousands of dollars to keep Westside School open and to support the many needs of their students. Pattern Energy is a good and responsible corporate citizen and I offer my vote of support to them.

Sincerely,

Darren Smith
Smith-Kandal Insurance & Real Estate
Office: (760)344-2212
Cell: (760)455-8661
Fax: (760)344-3383
RE: 01468241
INS: 0138680
www.smithkandal.com
The BEST compliment I can receive is a REFERRAL ! For EACH referral I'll send you a Thank You Gift Card!

Comment Letter P318

From: Roy Long [mailto:plantmanager@ivrr.net]
Sent: Wednesday, October 05, 2011 2:04 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@co.imperial.ca.us
Cc: tim@ivedc.com
Subject: Ocotillo Wind Project

Cedric/Angelina;

I would like to register my full and unreserved support for the Ocotillo Wind Project. As a "Green Energy" producer myself, (Biomass Combustion) I recognize the need and economic benefit that such a project will bring to Imperial County and California citizens in general.

P318-01

Thank you.

Roy Long
Imperial Valley Resource Recovery Co., LLC
Plant Manager
760-344-7200 Ext. 11

From: Kevin Smith [mailto:kevin@smithkandal.com]
Sent: Wednesday, October 05, 2011 1:30 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Wind Project

I say yes to this important development, we need jobs in Imperial County. We have 32% unemployment the highest in the nation here. **P319-01**

Kevin

Kevin C Smith
Smith-Kandal Insurance/Real Estate
510 West Main Street
Brawley, Ca, 92227
760-344-2212 office
760-344-3383 fax
760-996-5034 cell
kevin@smithkandal.com
The BEST compliment I can receive is a REFERRAL ! For EACH referral I'll send you a Thank You Gift Card!

From: Joan Caballero [mailto:azjoanie@msn.com]
Sent: Wednesday, October 05, 2011 6:48 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Cc: angelinahavens@co.imperial.ca.us; Rick Hamilton
Subject: Ocotillo Wind Project

Mr. Perry and all concerned:

I wish to put on record my support of the Ocotillo Wind Project.

The turbines are a source of clean energy. The alternatives currently being used-coal, petroleum, and nuclear-do considerable real and potential damage to the environment. Pattern Energy has gone way beyond ordinary expectations to ensure that their project will not harm the environment, taking into consideration the animal, bird, and plant life of the area, as well as cultural concerns. Clean energy will leave the earth a better place for our grandchildren and the generations beyond.

The more we use green energy the less dependent we are on foreign countries to supply our power. We need to be energy independent in this shrinking world so we do not have to, perhaps, be somewhat held hostage by governments whose ideology differs from ours. As a side benefit, it may also encourage automobile manufacturers to produce more energy efficient cars, thereby decreasing our need for petroleum.

The building and maintenance of the turbines and all associated construction will create business for local hotels. restaurants, drug stores, clothing stores, gas stations, and all of the other businesses that are needed to support workers.

P320-01

The project will inject a much needed source of income into the economy of Imperial County as well as provide jobs for some of the local population.

Pattern Energy is willing to and has already put real dollars into projects in Ocotillo after eliciting suggestions from the community.

I have attended the scoping and EIR meetings in both El Centro and Ocotillo. After the initial panic, the biggest remaining objection to the wind turbines seems to be how the view will be aesthetically impaired. I have been camping and spending time in and around the Ocotillo area for more than forty years-before the transmission towers and the gravel pits. I have enjoyed the area no less for these changes. I don't believe the turbines will detract from the desert scenery once people become accustomed to them. Looked at from an artistic point of view, there is a certain beauty to them.

In conclusion, for the above reasons, I feel it would be short-sighted not to build this project.

Joan Caballero
PO Box 26000
Yuma, As 85367

From: Kathleen Thayer [mailto:kthayer03@aol.com]
Sent: Wednesday, October 05, 2011 8:31 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@co.imperial.ca.us
Subject: Ocotillo Wind Project Support

Imperial County and BLM Representatives, I am sending this email IN Support of the Ocotillo Wind Project.
I know you have heard from those that are not in favor of this project but want to confirm my support of this project for the following reasons.

·It will create local business & jobs in a county that has a record number of unemployed.

· produce clean energy for California and reduce our dependencies on foreign oil.

· generate millions annually in taxes for the county, schools and state
and we all know our county needs these monies

P321-01

· support community initiatives through a community benefits program - Pattern Energy has already demonstrated their commitment to supporting the communities by donating to West Side School, Ocotillo Museum, and the Graduate Incentive Program of the Desert Volunteers of Ocotillo Optimist.

AS A RESIDENT and REGISTERED VOTER OF IMPERIAL COUNTY I feel my opinion should be heard and should carry more weight than those that do not reside or contribute fully to Imperial County.

In Closing, The good and the need of the many should out weigh the wants of the FEW.

Kathleen Thayer
Ocotillo Resident and Imperial County Registered Voter.
54 West Palo Verde Rd. - PO Box 192
760 996 4959
Ocotillo, Ca 92259

From: Greg Smith [mailto:insure@smithkandal.com]
Sent: Wednesday, October 05, 2011 3:38 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@co.imperial.ca.us
Subject: Pattern Energy/Ocotillo Wind Energy Project

I am writing in support of the Pattern Energy/Ocotillo Wind Energy Project.

Imperial County suffers from the highest unemployment rate in the US, and our local tax base has been seriously eroded by The Great Recession.

We need to have Pattern Energy's project in ocotillo because it will bring good-paying technical jobs with it. The several hundreds of millions of dollars spent will provide much needed tax revenues that pay for essential government services.

P322-01

If we are seriously committed to ending our reliance on imported foreign oil, we need to approve clean energy projects such as Pattern Energy's Ocotillo wind Energy Project.

Pattern Energy has taken into account endangered species, noise, dust, visual impact, safety..... We cannot afford to lose this project to a few NIMBYs. Pattern Energy has taken on and accepted the role of being a good corporate citizen.

Sincerely,

Greg Smith
Smith-Kandal Ins & RE
Phone 760-344-2212
Fax 760-344-3383
insure@smithkandal.com

The BEST compliment I can receive is a REFERRAL ! For EACH referral I'll send you a Thank You Gift Card!

Do you know anyone who wants to save $$ on their insurance??

Comment Letter P323

From: Baran, Robert [mailto:rbaran@AD.UCSD.EDU]
Sent: Wednesday, October 05, 2011 3:27 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C
Subject: Please do not approve the Ocotillo Express Wind Farm

Dear Mr. Perry,

This fragile area of desert adjacent to the Anza Borrego Desert State Park needs to be protected.

The Ocotillo Express Wind Farm would seriously impact flat-tailed horned lizard habitat, fragment Bighorn Sheep territory, have a detrimental effect on Golden Eagles and disturb cultural resources. The cost is too great regardless of what promises Pattern Energy has made.

P323-01

There is no reason this untouched piece of wilderness should be scraped clean to install this wind farm. The smarter alternative is to install local solar on businesses, houses, parking garages or any area that has already been disturbed.

Let's save wilderness for future generations to enjoy it.

Kind regards,

Robert Baran
1716 Kennington Road
Leucadia, CA 92024

http://www.anzaborrego.net/

Comment Letter P324

From: jimmyrayocot@aol.com [mailto:jimmyrayocot@aol.com]
Sent: Wednesday, October 05, 2011 8:33 PM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@imperial.gov
Subject: WIND TURBINE PROJECT-- OCOTILLO

Cedric Perry,

As a resident and property owner in Ocotillo I would like to give you my opinion on the proposed Pattern Energy Project. For years I have felt our government should be doing more regarding alternative forms of energy. After carefully researching wind turbines I've come to the conclusion this is a viable project. Pattern Energy is a company willing to listen to the community and make changes. A real plus for us. This would be a good move in the right direction for Imperial Valley. So I would like to give 100% support behind this project.

P324-01

Regards,

Jimmy Ray Jones
President, Ocotillo Mutual Water Co.

From: jerry tuck [mailto:jeromet1@earthlink.net]
Sent: Friday, August 26, 2011 5:32 AM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: roads

hello, my concern with the wind mills that Pattern is going to be building in the Nomarage area is the run off of water that comes out of the hills from the heavy rain fall in the winter out of Mexico on occasion. i have lived here in Nomarage for five years and have seen it happen twice aready , the water rages down highway # 98 toward Nomarage. flooding and sediment and alluvia comes down with it . when roads are cut in toward the south toward the mountains it will pick up all the water and ack as a channel to help divert the water directly toward Nomarge , some sort of channels are flood control berms need to be installed to divert the water to the north side of highway # 98 and send it out to the flat lands and fields to sink into the ground ,instead of letting it come head on into the Nomarage area . if Cal Trans would clean out the water ways on the north side of the highway it would also help to divert the water. a deep channel dug and bermed on Sage street from highway # 98 all the way to Cholla street would also take a lot of the water out into the fields where it belongs instead of flowing into the Nomrage area . hopefully you will consider this and put some thing into place that will keep the area from being flooded . thank you Jerry Tuck

P325-01

Comment Letter P326

From: jerry tuck [mailto:jeromet1@earthlink.net]
Sent: Sunday, August 28, 2011 6:49 AM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: windmills

Hello , since they are going to go ahead with building the giant toweres / windmills in the Ocotillo area . i was wondering since they are such a eye sore is there any way that Pattern company can camouflage them some how with painting them to match the terrain of the desert . a light brown are a desert tan .would help instead of the bland white that they usually paint them . perhaps if they matched the rest of the desert surroundings they would not be as bad to have to look at. thank ,Jerry Tuck , Noramage , Ca.

P326-01

To Whom It May Concern:

I think it's critically important to consider this project because there are people around that there lifestyle will be changed dramatically and important State parks that will be damaged such as The Anza-Borrego Desert State Park which is the California's largest State Park that is named as part of the world biosphere reserve. Another concern is by the fact that the lives of the flat horned Lizard in a management area will be threatened. They are proposed for listing under the Endangered Species Act. P327-01 P327-02

The project of the wind Mills in Ocotillo would also manage to be dangerous for the endangered peninsular bighorn sheep, and will become a serious threat for the most important animal in California, the bald eagle. 12,436 acres of Jacumba Mountains will be destroyed for this Ocotillo Express project. Nature would be gone and I think the people making this project has no concern or thought of how they will change this important sites. P327-03 P327-04

Thereafter, ancient cultural sites are important for our community and will interfere with the Imperial County Desert Museum which will be open soon. This museum would change the lives of children interactively and if this noisy project is done, they would not be able to enjoy and learn the early life of what Imperial Valley was. P327-05

Finally Ocotillo will become an industrial noisy city 24 hours a day from a quiet bucolic desert refuge and will illegally alter the landscape surrounding the protected "Juan Bautista de Anza National Trail." P327-06

The economy will go down because Ocotillo depends on tourism in the unspoiled desert. As you can see, there are a great amount of important places to learn about which are important for our community. I oppose and say NO to this project P327-07

Sincerely

Alejandra Marquez

Imperial Valley College Student

10-06-2011

Comment Letter P328

From: atomictoadranch@netzero.net [mailto:atomictoadranch@netzero.net]
Sent: Sunday, August 28, 2011 1:54 PM
To: Raml, Teresa A; BLM_CA_Ocotillo_Express_Wind_Project; Goodro, Margaret L; Briery, David C; Miller, Gregory P; Perry, Cedric C
Cc: Abbott, James W
Subject: Request For Additional Meeting for Ocotillo Wind Express

Dear Terry Raml,

It has come to our attention that about 70 people were not permitted to speak at the public meeting held for the proposed Ocotillo Express Wind Energy facility proposed to be built near the community of Ocotillo, California on August 25th. I was actually considering attending this meeting and I am glad that I did not. From what I hear, all public attendees felt that their time was wasted by the BLM.

We have ran into this problem three times concerning energy projects proposed for BLM lands in California. These were not scoping meetings, but public meetings concerning the Draft Environmental Impact Statement for these projects. All of these meetings were for renewable energy projects that were either described as Fast Track Projects or Priority Projects. The meetings were for Ivanpah, Granite Wind and Desert Sunlight. At each one of these meetings, members of the public traveled great distances and were denied the opportunity to speak.

The reason I have been told for this is that "the BLM only accepts public comments at scoping meetings". This is a distortion of facts and policy. I have attended several BLM DEIS meetings both in Nevada and Arizona in which public comment IS accepted by the BLM. Perhaps this is an order on the state level in California, but we are not aware of any mandates by the Department of the Interior that say that public comments can not be accepted at DEIS meetings. If there is such an order, please show it to us in writing.

P328-01

I have been told by BLM employees that public comments in meetings do not mean anything unless they are relevant to the studies being conducted in the environmental review process. They say that individuals who simply express opposition do not make relevant comments. This is a disturbing trend we see from public land managers. Public comments that seem irrelevant to government bureaucrats do express opinions from residents who have long histories in an area and will be directly impacted by these projects. It is the job and the responsibility of the agency to listen to and consider all comments from all interested individuals. That is who BLM works for. Any BLM employee who describes this process as tedious should remember what working for the public means.

Another problem with many BLM employees is that they don't seem to understand that most people are not exposed to BLM or National Environmental Policy Act terminology on a daily basis and these people really do not know how to make comments that BLM considers relevant. It is the job of the BLM to explain this process to people-not throw the comments out and pander to the developer. BLM employees can even be patronizing to the general public over such issues.

We would like BLM to consider the following request:

We are requesting that an additional set of public meetings be scheduled in local communities for the Ocotillo Express Wind Energy Project. These meetings should be scheduled with reasonable advance notice. These meetings should also solicit public comment. The DEIS comment deadline for the project should be extended for an additional 30 days to accommodate these meetings.

We are sending this request to our Senator as well. We would like a response to this comment.

Thank you for your consideration,

Sincerely,

Kevin Emmerich
Laura Cunningham
Basin and Range Watch
P.O. Box 70
Beatty, NV, 89003

Comment Letter P329

From: Michael Gordon [mailto:michael_gordon@charter.net]
Sent: Thursday, October 06, 2011 8:50 AM
To: Perry, Cedric C
Subject: Ocotillo Express Draft EIS/EIR Public Comment

06 October 2011

Mr. Cedric Perry
California Desert District Office, Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Dear Mr. Perry:

I write today to request the "no-project" alternative for the Ocotillo Express wind energy project. I have been exploring, photographing, and touring this beautiful region for decades, and if this project is adopted there will be irreparable damage to the surrounding landscape and wildlife found within. **P329-01**

What else is wrong with this project?

- There will be disruption of desert bighorn sheep wildlife corridors;
- There will be inevitable adverse effects to golden eagles, burrowing owls, long-eared owls, Vaux's swift, Peregrine falcons, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, American badgers, bats, and several listed plant species;
- There will be unavoidable impacts to plants during construction and a likely introduction of invasive plant species;
- There will be impacts upon the Cultural Resources of Anza-Borrego Desert State Park;
- There will be visual impacts to the newly designated Cultural Preserve at Piedras Grandes;
- Cultural Studies were not completed prior to assessing impacts;
- There will likely be a substantial increase in noise levels from the operation of the turbines, especially at night in surrounding areas;
- There will be potential and likely impacts on air quality from truck traffic and from concrete batch plants;
- There will be degradation to the recreational and natural experience of Anza-Borrego Desert State Park by the sight of the turbines and associated facilities;
- There will be degradation of character on the several BLM wildernesses surrounding the proposed project.

P329-02

The draft EIS does not meet NEPA requirements because it lacks a full range of alternatives, namely, the alternative of producing renewable energy on rooftops in the cities where the energy is used. The BLM is mandated to consider viable alternatives that could meet the "need" for the project that lie outside of lands within their jurisdiction, and this project is not needed. Local rooftop and local distributed renewable energy generation could power the 140,000 homes that this project is slated to power. **P329-03**

Please adopt the no-project alternative for the Ocotillo Express wind energy project and help to protect 12,000 acres of intact desert habitat from destruction for private profit on a project that will be de-commissioned in 30 years. **P329-04**

I sincerely thank you.

Best Regards,

Michael Gordon
725 Rose Ave
Long Beach, CA 90813

Comment Letter P330

From: Gustavo Arguelles Jr. [mailto:tabbo.a@hotmail.com]
Sent: Wednesday, October 05, 2011 7:55 PM
To: angelinahavens@co.imperial.ca.us; Perry, Cedric C
Subject: Ocotillo Express

The Ocotillo Express Wind Energy Project sounds like a good idea in regards of energy saving and the larger distribution of "cleaner" energy to the cities and towns that surround the Jacumba Mountains, as well as the Anza-Borrego Desert. Yet, this California National Park the project is being built at is an irreplaceable national treasure that shouldn't be tampered with. I believe that there are places more adequate where the project can be built that wouldn't have a bad effect on the environment.

P330-01

Comment Letter P331

From: Debora Palma [mailto:dp1223@aol.com]
Sent: Thursday, October 06, 2011 5:55 AM
To: Perry, Cedric C
Subject: No wind generators adjacent to State Park, please.

I am writing as a resident of Borrego Springs and a lover of open space. This wind farm will ruin the views and lifestyle of Ocotillo residents. It will be a blight on the open space that defines the desert park experience. Please make note of my opposition to such an undertaking.

P331-01

Debora Palma
Alta Vista Properties
(858) 354-0098
DRE License 00964561

-----Original Message-----
From: diahnagarcia@yahoo.com [mailto:diahnagarcia@yahoo.com]
Sent: Wednesday, October 05, 2011 3:19 PM
To: Kastoll, Valerie A; Blevins, Karissa M; mwest@ca.blm.gov
Subject: elcentro feedback

name = Diahna Garcia-Ruiz
organization = Heber United
email = diahnagarcia@yahoo.com
subject = Ocotillo wind energy project
FeedbackType = Comment
request_comment = I just wanted to send in a vote of support for this project. I attended the informational meeting held in El Centro City Council Chambers, and was quite impressed with the scope of the project, and the management was very informed. Yes, I support this wind energy project.

username123 =
sentinal = Sentinal
page_referred_from = http://www.blm.gov/ca/st/en/fo/elcentro.html
fo = 8
Submit = Send Request

P332-01

Joan S. Schneider, Ph.D.
6595 Hawarden Drive
Riverside, CA 92506
951-780-1332
joanschn@gmail.com

October 5, 2011

Mr. Cedric Perry
California Desert District Office, BLM
22835 Calle San Juan de Los Lagos
Moreno Valley, CA 92553

Dear Mr. Perry:

I am writing to you to express my dismay about the prospect of the Bureau of Land Management's approval of a permit for a large group of energy-generating wind turbines directly east of Route 2 and near the village of Ocotillo in Imperial County, California -- the Ocotillo Express Wind Project.

Just less than a year ago, in December 2010, the California State Parks Commission approved seven new **Cultural Preserves** for Anza-Borrego Desert State Park, one of which is directly adjacent to the proposed energy-generating project: **Piedras Grandes Cultural Preserve**. The Preserve area is extremely rich in cultural heritage sites and meanings (see attachment) and one of the reasons why the this area is so important to today's park visitors and to the *Kumeyaay* Indians who used the area as a traditional late fall, winter, and early spring residential and ceremonial area, is the vast and uninterrupted vista to the east – just the area in which 155 wind turbines, 425 feet tall, are planned. Moreover, although the locations are confidential, as an archaeologist, I can tell you that in proximity to the planned project, the *Kumeyaay* have several cemetery areas where cremation remains of many *Kumeyaay* ancestors rest.

P333-01

This is also an area of highly significant rock art that is already on the Native American Heritage Commission's Sacred Lands Inventory, as are the cemetery sites mentioned above.

P333-02

Another cultural sensitivity is the fact that *Kumeyaay* oral tradition tells of the area of the Jacumba Mountains holding important nesting areas of the golden eagle, significant in *Kumeyaay* legend and used in traditional ceremonies. How many golden eagles will become victims of the wind machines?

P333-03

I was the project manager for the Cultural Preserve project in Anza-Borrego Desert State Park and the PiedrasGrandes/Jacumba Mountain area had **top priority** in our list of potential Cultural Preserves within Anza-Borrego. This was a long and difficult project and, in my view, the Federal agency involved should more carefully consider the effects of the proposed wind turbine project on adjacent State of California parklands, lands that California holds in trust for its original inhabitants and the general public.

P333-04

Cultural Preserves are, according to California Public Resources Code described as follows:

Cultural Preserves consist of distinct areas of outstanding cultural interest established within boundaries of other state park system units for the purpose of protecting such features as sites, buildings, or zones which represent significant places or events in the flow of human experience in California. Areas set aside as cultural preserves shall be large enough to provide for the effective protection of the prime cultural resources from potentially damaging influences and to permit effective management and interpretation of the resources. Within cultural preserves, complete integrity of the cultural resources shall be sought, and no structures or improvements which would conflict with such integrity shall be permitted. (PRC 5019.74).

P333-04, cont.

One of the prime reasons for designating Cultural Preserves is the view-shed; the ability for the visitor to experience the landscape without the intrusion of modern structures, modern technological infrastructure, roads, and other objects that might interfere with visitors' "feeling" of the time and place. Certainly, 425-foot-tall wind turbines would adversely impact the intent and use of this area, just recently set aside as a Cultural Preserve.

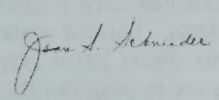
Although I am fully aware of the Federal government's initiative to make the United States self-sufficient energy-wise, it seems a distinct travesty to place this project in full and close view of the Piedras Grandes Cultural Preserve when it could be located closer to where the energy needs are much greater than the sparsely populated area of the little town of Ocotillo. **I suggest that alternatives to this technology and placement have not been thoroughly investigated, nor have cumulative impacts to the area.**

P333-05

I urge you to encourage – or even demand – that the BLM accept its public responsibility to consider alternatives (especially the No Project Alternative) after carrying out the studies necessary to further evaluate the cumulative impacts of this ill-conceived project.

Should you have questions or want further information about the cultural history and heritage of the PiedrasGrandes area, please feel free to contact me at the contacts provided in the letterhead. Thank you for considering my comments.

Yours truly,



Joan S. Schneider, PhD
Associate State Archeologist (retired)
Colorado Desert District
California State Parks

Attachments:

Abstracts from the background research and proposal for the Piedras Grandes Cultural Preserve:

PIEDRAS GRANDES CULTURAL PRESERVE

Theme: The Living Rocks

"Description (1923.9 acres; 44 recorded cultural resource sites)

- Massive boulder landscape provides many shelters used by Kumeyaay People, in prehistoric and contact eras.
- Multiple well-known rock art panels including the most well known rock art panel in ABDSP: the "Horse and Rider." pictograph.
- Multiple sites with cremated human remains
- Cultural resources inventory of the area in 1990s; impact study 2003; Superintendent Closure of jeep trail 2008.
- Highest concentration of prehistoric rockshelter sites and rock art in southern ABDSP."

"Within the U-shaped protective arms of massive granitic boulder hills, as well as at the bases of the nearby northern flanks of the water-bearing Jacumba Mountains, Kumeyaay people found the necessities of winter life -- shelter, water, and food. Here, they were secure, able to view travelers through the area without being seen themselves – perhaps even the first Spanish venturing into the California deserts from the Colorado River. They probably were able to see Ancient Lake Cahuilla from their homes among the rocks of PiedrasGrandes."

"PiedrasGrandes Cultural Preserve -- The PiedrasGrandes area is in the southern portion of Anza-Borrego Desert State Park (ABDSP), on the west side of County Route S-2, a few miles north of the border of ABDSP with the town of Ocotillo. As the name implies, it is an area of massive granitic rocks that compose the hills that surround a U-shaped alluvial valley that slopes gently eastward, as well as the rocky slopes on the northern aspect of the JacumbaMountains, where abundant year-round water is available. The Piedras Grandes area is strategically positioned and protected.

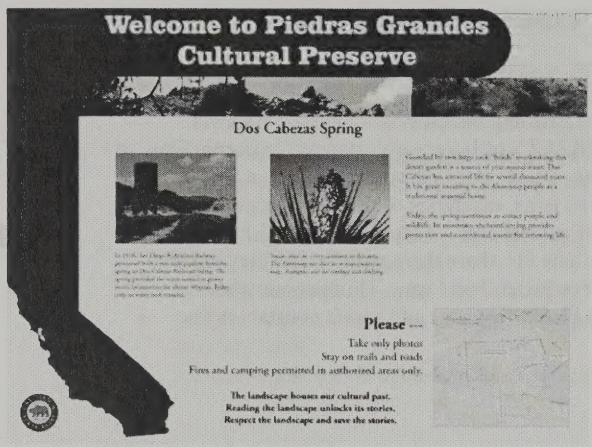
The rocky landscape provides many advantages to the people that have used the area in past times: protection from wind, rain, and sun; running springs; natural basins that catch rainfall and water runoff from the rocks; and hiding places among the huge boulders. Located at the head of a huge alluvial fan that drops in elevation toward the east, this region has a very extensive view-shed and most of the prehistoric and contact-period sites are in positions that would insure a good view of comings and goings of people (friends and enemies) and animals. It is from this vantage point that indigenous people may have seen the first of the Spanish explorers entering the region, an astounding event to the indigenous peoples of the area. Local legend has it that the "Horse and Rider" pictograph, located in a rockshelter within the PiedrasGrandes Cultural Preserve, depicts an individual on horseback, a record of this event – some archaeologists agree. Whether or not this is true remains a question, but the motif seems to show a person standing on the back of a four-legged animal and it is the only Kumeyaay motif of this type that is known."

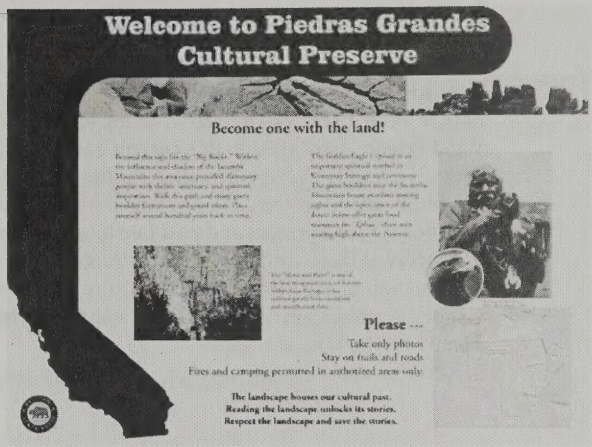
Comment Letter P334

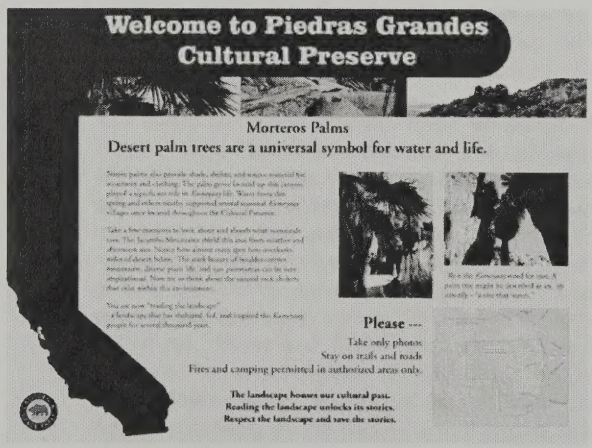
From: joan schneider [mailto:joanschn@gmail.com]
Sent: Thursday, October 06, 2011 3:38 PM
To: Perry, Cedric C
Subject: addendum to earlier letter

Dear Mr. Perry (again):
Earlier today I sent you a letter with my comments regarding the proposed Ocotillo Express Wind Project. Attached to this current email are DRAFTS of Interpretive panels California State Parks is currently having designed for the area where BLM is considering approving a permit for the wind-energy project. As you can see in the panel texts, meanings of the place are highly significant to the present and past inhabitants of this special area. They are self-explanatory. I just received these from the graphic designer and wanted to share them with you as they explain the situation of the Piedras Grandes Cultural Preserve better than I can. Think about what visitors would experience should the wind turbines block the vistas and create constant noise. Thanks for looking at these.
Joan Schneider

P334-01


Welcome to Piedras Grandes
Cultural Preserve
Dos Cabezas Spring
Please ---
Take only photos
Stay on trails and roads
Fires and camping permitted in authorized areas only.
The landscape houses our cultural past.
Reading the landscape unlocks its stories.
Respect the landscape and save the stories.


Welcome to Piedras Grandes
Cultural Preserve
Become one with the land!
Please ---
Take only photos
Stay on trails and roads
Fires and camping permitted in authorized areas only.
The landscape houses our cultural past.
Reading the landscape unlocks its stories.
Respect the landscape and save the stories.


Welcome to Piedras Grandes
Cultural Preserve
Morteros Palms
Desert palm trees are a universal symbol for water and life.
Please ---
Take only photos
Stay on trails and roads
Fires and camping permitted in authorized areas only.
The landscape houses our cultural past.
Reading the landscape unlocks its stories.
Respect the landscape and save the stories.

Comment Letter P335

From: McCann D'Angelo [mailto:gullzena@hotmail.com]
Sent: Wednesday, October 05, 2011 4:41 PM
To: Perry, Cedric C; johnrenison@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; angelinahavens@co.imperial.ca.us; michaelkelley@co.imperial.ca.us; garywyatt@co.imperial.ca.us; raycastillo@co.imperial.ca.us; conrad@theabf.org
Subject:

Hello,
I am adding my name to the long list of opponents to the proposed wind turbine project near Ocotillo. I feel there is much more study needed, and I am discouraged by the lack of satisfactory answers to questions posed by commenters. I was also unpleasantly surprised by the two day public comment period. In my mind, if there is nothing to hide there is no reason to inhibit public comment.
Anza-Borrego is a national treasure, and there is no reason the request for comment should be kept to just two days.
Your response may be that you met all legal requirements, but for a project with such important and lasting implications for the survival of our natural heritage, you must go above what is required and do what is right.
Going ahead with this project now is wrong.
Harry F McCann

P335-01

Comment Letter P336

From: Lee Johnson [mailto:ljleejohns@gmail.com]
Sent: Wednesday, October 05, 2011 3:20 PM
To: Perry, Cedric C
Cc: angelinahavens@co.imperial.ca.us; jackterraza@co.imperial.ca.us
Subject: Concerns Over Ocotillo Wind Project

Dear Mr. Perry:

I am a dual U.S./Canadian citizen who winters in the Salton Sea area - the past two years based in Borrego Springs. My friends and I go through the Ocotillo area on our way to El Centro, Brawley, and the eastern side of the Salton Sea, as we find places for birdwatching, hiking, and kayaking on the Salton Sea itself, as well as on reservoirs along the Alamo River. It is unsettling to think of the environmental damage hundreds of wind turbines could inflict on a delicate and beautiful desert landscape and its various natural inhabitants. I urge that complete impact studies be made before this drastic and apparently unnecessary alteration of the landscape is undertaken. Surely the electrical power needs of that part of Imperial County can be met in less invasive ways.

P336-01

Thank you,

Lee M. Johnson
Professor of English Emeritus
University of British Columbia

Ocotillo Wind Farm Comments/Questions Letter

1/10/11

James and Cheryl Pelley

1362 Shell Canyon Road

I send this letter with extreme concerns for my family for the Ocotillo community and the future of our Grandkids as I am a full time resident living directly downwind from the proposed Wind Farm. I am very much against this industrializing of "Our beautiful deserts" for many reasons, especially health concerns. I would also like a response to all of the other concerns submitted from others along with my concerns. **P337-01**

- ***Health Concerns:*** My wife Cheryl Pelley suffers from Migraine headaches, this has been an ongoing health problem for the last 20 years. We lived in El Cajon for 25 years prior to moving out to Ocotillo. Living in El Cajon Cherrie would have to take numerous types of medications for headaches including Imitrex injections. Cheryl moved out to Ocotillo in January of 2010 and since she has been living in Ocotillo the migraine headaches have diminished to the point where no injections are needed any more along with a huge reduction in medications. I have an extreme case of sleeping disorder for whatever reason has greatly improved since I moved out to Ocotillo. There is lots of information available regarding health issues related from Wind Turbines including headaches, sleeping disorders and other serious medical problems. Is Pattern prepared to provide immediate medical attention for Cheryl, Myself, my Grandkids and others for all health concerns related to Wind Turbines? **P337-02**

- ***Aquifer water supply:*** I was told we have the 3rd best water in the nation. I have extreme concerns for water contamination from these Wind Turbines. I have personally witness a Wind Turbine failure at the turbines located near the Golden Acorn Casino. Oil blew out all down the sides of the turbine structure and fell onto the ground. Also, on YouTube there are lots of wind turbines that have caught fire and dropped toxic carbon fiber blade particles onto the ground below. How is Pattern going to address these extremely important issues if a turbine failure occurs? Will Hazmat be contacted immediately? Will Hazmat do periodic testing and investigations around the wind turbines to make sure no oil or toxic material exists? **P337-03**

- ***Dust:*** Living directly downwind from this proposed wind farm, I have extreme concerns for dust issues and Valley Fever, which comes from stirring up the dirt. When you plow down all of this desert vegetation and create access roads that are in direct lines to my house, I am concerned that when the wind blows out here I will be also getting lots of dust and sand blowing right into my house. We leave our windows open all the time including when we sleep at night and are worried that this dust and sand will blow right into our house. Also, the paint and windows on our vehicles may get sand blasted resulting from this problem. There is a property on the other side of the freeway which was graded off by the property owner and every time the wind blows **P337-04**

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out here, dust covers the freeway as a result of the missing vegetation and sand crust. Also, if this is approved what is the plan to keep the roads wet with water so that no dust is released? **P337-04, cont.**

- ***Water Flow:*** I am extremely concerned with natural terrain of the sand Wash being disrupted as a result of this construction. We have had some pretty good rain storms out here and the water flows down the hills into the sand Wash very nicely. We have never had an issue with flooding or any other issue related to these extreme rain storms on Shell Canyon Road. Is Pattern prepared to deal with flooding and any other water issues directly related to the disturbance of the natural land layout? Is Pattern prepared to compensate home owners for flooding damages as a result of this construction? Based on what I seen at the Campo Wind Farm there is lots of erosion from rain, what is going to happen when we get massive amounts of water coming down the sand Washes and there is no vegetation to hold the sand? **P337-05**

Campo Wind Farms, erosion is evident all over the hillside:

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- ***Degraded Property Value:*** I am extremely concerned about my property value being degraded as a result of this wind farm. Is Pattern prepared to compensate home owners for the loss of property value? Is Pattern prepared to purchase houses that residents can no longer live in them due to all the noise, health concerns and other issues?

P337-06

- ***Distance between Wind Turbine and residence:*** I am extremely concerned with the proposed close proximity of the wind turbines to residential houses especially for medical reasons, noise and aesthetics. With the proposed amount of wind turbines there is no reason to locate these so close to residential housing, I ask if this project is approved, please located the turbines as far west as possible and out of the area of housing.

P337-07

- ***EPA Concerns:*** Based on what I see at Campo Golden Acorn wind farm, I am extremely concerned with the fact that when parts are replace from the wind turbine and parts the old parts are removed, why do they just leave them on the ground?, I heard they are toxic and I am very concerned about the toxic material getting into our aquifer. If our aquifer is polluted, what is Patten's plan to supply us with water? Will the old parts be removed from the area immediately after the repairs? To satisfy my curiosity of how Eco Friendly Wind Turbine Generators are I visited a local Wind Farm at Campo Kumeyaay Nation; what I found was alarming. I found 8 out of 10 blade hubs (25 total, didn't check them all) that I checked were leaking hydraulic fluid on the ground which have been there for over 1 year.

P337-08

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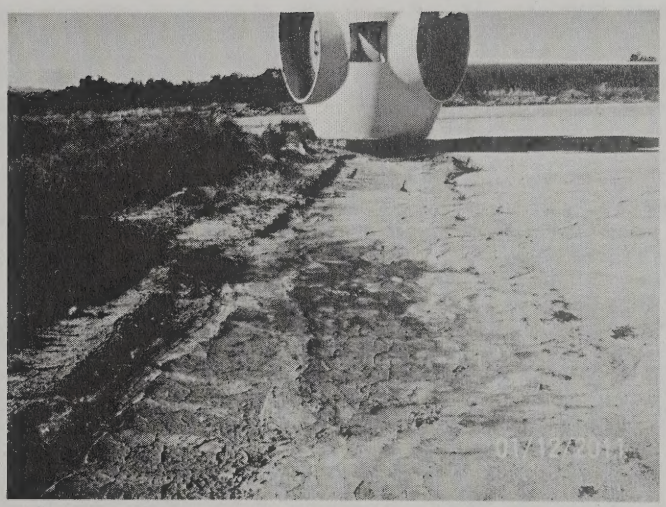

Oil leaking on plants

P337-08, cont.

Various locations of oil pits leaching into the ground and into the water tables:

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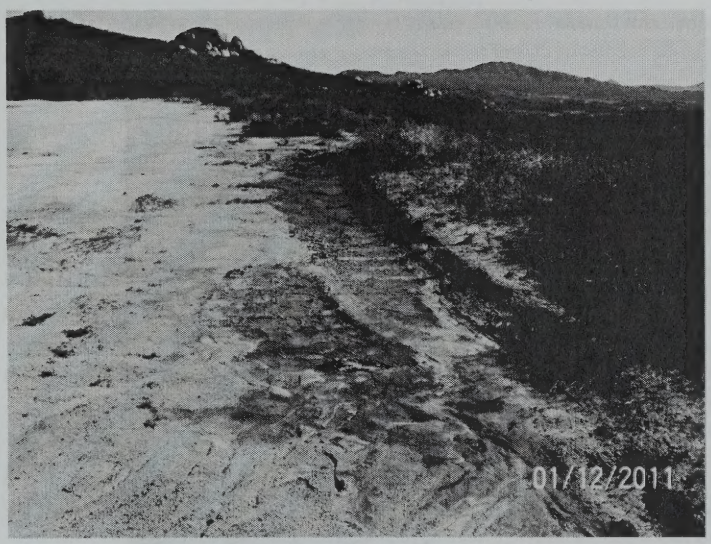

I found oil pits directly under the Wind Turbine Generators:

I found a pool of water and oil directly below a wind turbine:

P337-08, cont.

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I found damaged blades lying on the plants and ground with fiberglass and carbon fiber blowing across the land.

P337-08, cont.

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Questions: Are Wind Farms exempt from EPA inspections? What if this happens on top of our Aquifer, who will be responsible for polluting the water? Who will be policing the Wind Farm to make sure this doesn't happen? **P337-09**

- ***Wind Turbine Fires:*** Based on what I've seen on the internet, I am extremely concerned with toxic smoke blowing downwind and into my house causing health issues. What is the plan if there is a wind turbine fire? Will Patten be prepared to put my family up in a hotel until the repairs are complete? Will our fire department be upgraded to deal with these fires? **P337-10**
- ***Environmental Violations:*** Will BLM be policing the wind farm looking for environmental violations and assessing fines as they do for off roaders? **P337-11**
- ***Historical Artifacts:*** If this is passed we want an archeologist present during all digging to witness all findings which would include Indian Artifacts and prehistoric findings. **P337-12**
- ***Seismology Testing:*** I would like a copy of all of the seismology testing that was completed throughout this process. Also, I would like to know what the emergency disaster plan when large earthquakes take place? I also learned that there is a new fault line that was discovered after the last large earthquake we had. What kind of effect will all this digging and blasting have on this newly found fault line? **P337-13**
- ***Wildlife Endangerment:*** I would like a copy of all of the wildlife endangerment data that was collected throughout this process. I would like the endearment data to include, Golden Eagle, Big Horn Sheep, Red Tailed Fox, Bats, Hawks, Horney Toads, and Road Runners and the Desert Iguanas. **P337-14**

Signed: _____
James H. Pelley

Signed: _____
Cheryl H. Pelley

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Comment Letter P338

From: chpelley [mailto:chpelley@hughes.net]
Sent: Thursday, October 06, 2011 4:47 PM
To: angelinahavens@co.imperial.ca.us; BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C; garywyatt@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; "jchilders@blm.gov."@mail3.blm.gov; johnrenison@co.imperial.ca.us; juanita.salas@mail.house.gov; mkelley@co.imperial.ca.us; nora.may@mail.house.gov; raycastillo@co.imperial.ca.us
Subject: OCOTILLO WIND ENERGY PROJECT

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons.
Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259
jhpelley@hughes.net

Concerns for Proposed Wind Turbine Project in Ocotillo

1: What if flooding from heavy rains washes the mud and sands on to our properties?
Who will pay for the cleanup and damages to personal properties?
ie: water rushing under home foundations and possibly undermining structure supports, mud and sand creating ruts in our yard washing out the gravel. **P338-01**

2: What if our Aquifer is damaged or polluted?
How will this be handled and Who will pay for this?
ie: will you be willing run water lines from El Centro to all the homes in the community as the Aquifer is our sole source of water. **P338-02**

3: We have huge concerns about medical issues related to this project, What if medical issues occur?
Who will be responsible to pay 100% of medical cost incurred?
i.e.: Valley Fever, Migraines, High blood pressure, Vertigo, stray Voltage effects and other issues. **P338-03**

4: What if the sound from the WTG compromises our ability to sleep what is your plan for fixing this? **P338-04**

5: What if our pets start to have medical issues related to these WTG, are you willing to pay the medical bills?
i.e.: snake bites, scorpion bites **P338-05**

6: What about our property value of our homes?
Naturally our property value will decrease, Are you willing to make up difference in this loss if this project goes forward? **P338-06**

7: What is your plan to monitor the amount of birds killed by the WTG?
Will the bird kill be made public so the public knows how many are killed. **P338-07**

8: Who is responsible for fixing our roads from the abuse of heavy trucks and equipment brought in, if this project goes forward? **P338-08**

9: What is your plan to control the dust 7/24 for the next 20 years from disturbance after you disturbed the desert crust and vegetation and created roads? **P338-09**

10: What if a wind turbine catches on fire and the toxic smoke and fumes enter our house, who will be responsible for liability issues from this? **P338-10**

11: What are you prepared to do if shadow flicker is an issue for some residents? **P338-11**

12: If some residents cannot live next to a wind farm are you prepared to buy their house at market price (before the wind turbines were installed) ? **P338-12**

Comment Letter P338

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons.
Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259
jhpelley@hughes.net

From: chpelley [mailto:chpelley@hughes.net]
Sent: Tuesday, October 04, 2011 7:10 PM
To: angelinahavens@co.imperial.ca.us; BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C; garywyatt@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; "jchilders@blm.gov."@mail3.blm.gov; johnrenison@co.imperial.ca.us; juanita.salas@mail.house.gov; mkelley@co.imperial.ca.us; nora.may@mail.house.gov; raycastillo@co.imperial.ca.us
Subject: FW: Emailing: LetterToBLM-Pelley.doc

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons.
Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259
jhpelley@hughes.net

To: Department of the Interior (DOI)
Bureau of Land Management (BLM)
C/O Cedric Perry
22835 Calle San Juan des Los Lagos
Moreno Valley, Ca. 92553

From: Jim Pelley
1362 Shell Canyon Road
Ocotillo, Ca. 92259

Mr. Perry,

I'm 55 years old and I have lived in the city all my life and have been going to the desert since I was 14 years old. I moved out to Ocotillo to retire and to have a place for my 3 kids and 5 Grand kids to enjoy. I moved to Ocotillo to get away from the noise, lights and industrial things that did not exist in the desert. I bought property in Ocotillo which came with a prefab trailer that needed lots of work. My wife of 35 years wanted me to scrap the prefab and buy a new one. We could not afford to buy a new prefab so I have spent the last 6 years remodeling the prefab that came with my property and I am about 85% done. In the city my wife suffered from Migraine Headaches and would have to take lots of medicine and also do Imitrex injections for the severe headache pain. Since we moved to the desert she seldom has to take meds and Imitrex injections are not needed any more. When I bought my place in Ocotillo the elderly lady that I bought it from told me that I would never have to worry about any development around my house because it was all protected BLM land. Now I'm facing the possibility of Wind Turbines related Health issues for my Wife, myself, my kids and my Grandkids. My property value with be degraded by 100%. The beautiful views of the mountains, desert setting with precious Ocotillo cacti destroyed, massive amounts of wild life killed. I will have dust from the dirt roads when the wind blows which I don't experience now. We have never had any flooding issues but I worry that if the wind turbines are installed, we will be dealing with flooding along with massive amounts of mud and sand from the dirt roads which is totally unacceptable. My quite nights will be ruined with lights and noise from the wind turbines it will look like I am sitting in the middle of a airport landing strip with all the blinking lights, again unacceptable. I thought BLM was supposed to preserve and protect the land not allow it to be industrialized and ruined. The BLM rangers write tickets all the time for people cutting bushes but its okay for Pattern to come in with bull dozers and trucks and destroy this beautiful land, plants and wild life? They say they are going to restore the land when they are done, how do you restore what Mother Nature has created over hundreds of years? Laws were created i.e. Environmental Justice act and The Good Neighbor act precisely to keep large companies from taking advantage of small communities as Pattern Energy is attempting to do. Proposed construction of this wind farm is to develop directly on top of our aquifer, our only water source. Based on all the oil leaking out of the wind turbines at Golden Acorn, and the total lack of concern for the environment, how long will it take be before our aquifer is polluted and unusable for potable water? If our federally protected aquifer is polluted, where will we get our potable water from? Will Imperial County pay to install pipes from El

P339-01

P339-02

P339-03

P339-04

P339-05

Centro to Ocotillo which will cost billions of dollars? Also, Pattern Energy says they will not use our water, we all know this is not true and they plan on using our water from our aquifer to mix concrete and use for dust suppression, this is totally unacceptable. I have read that if large amounts of water are taken from a aquifer it could damage the aquifer to the point of it not being suitable for potable water. I have also heard that the lime from the concrete used for wind turbine foundations could also change the alkaline of the water making it unusable for potable water. We are being misled by Pattern's presentation. For example, they say things like "Everybody wants to know why we are in Ocotillo" then they point to this "Hot spot (class 7 wind speeds)" on wind map and say things like "its right there that is the reason we are in Ocotillo". It just so happens that this "Hot Spot (class 7 winds)" is in Boulder Park, 10 miles up the grade and over 3,000 feet of elevation. There are lots of serious concerns that I believe are being overlooked and we feel this project is being Fast-Tracked so that we don't have time to our homework and research all of the extremely important issues related with Wind Turbines. I am 100% against this project being developed in the community of Ocotillo. I am all for renewable energy but based on what I have read on Wind Turbines as far as health issues and also based on the fact that we only have Class 2 and Class 3 winds in Ocotillo, I does not make any sense to develop this wind farm in the community of Ocotillo. Based on what I have learned if this project goes forward these large structure will only be producing power 20% of the time and the other 80% of the time they will be nothing but a high cost maintenance liability funded by the tax payer and will be nothing more than a huge eye sore ruining our desert land.

P339-05, cont.

P339-06

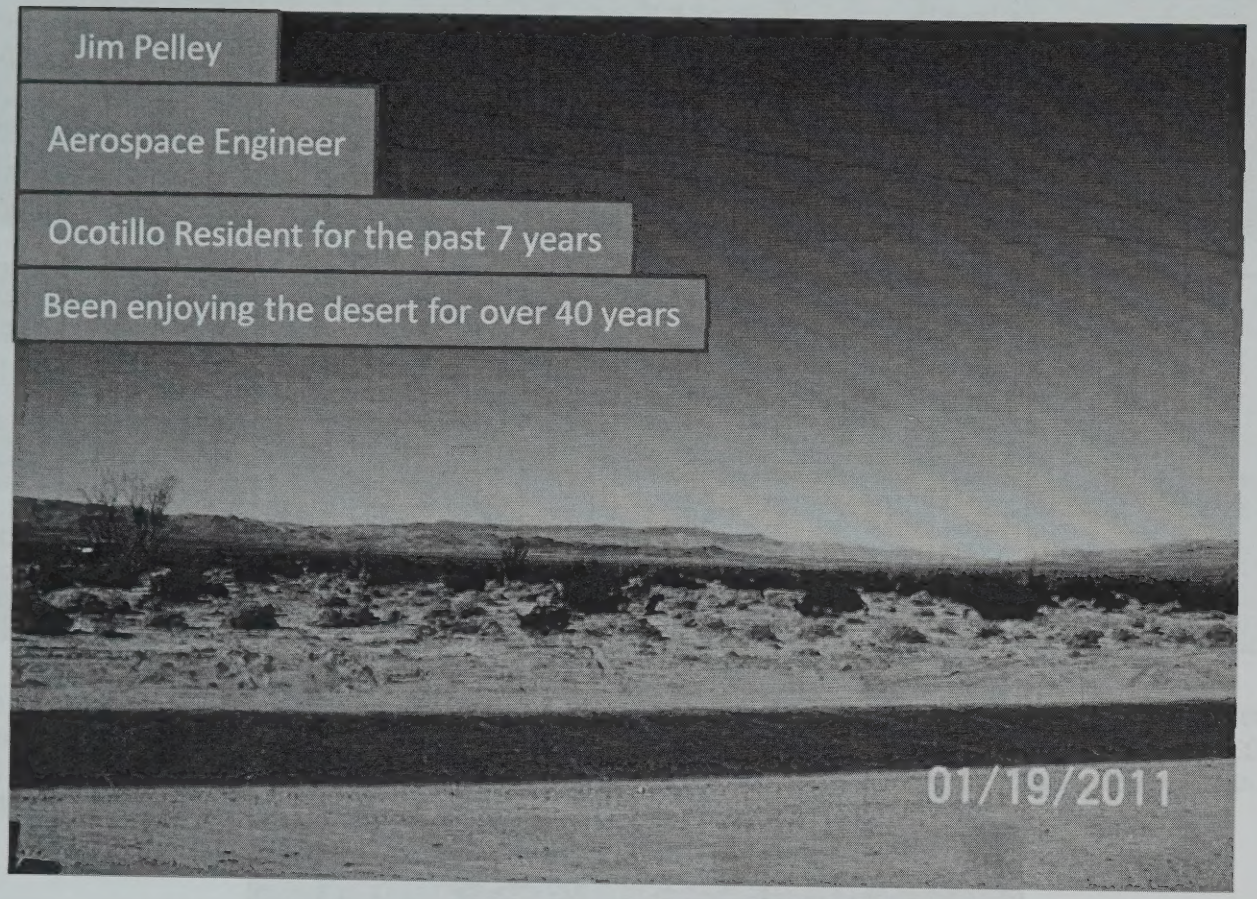
Thank you,

Jim and Cheryl Pelley

From: chpelley [mailto:chpelley@hughes.net]
Sent: Tuesday, October 04, 2011 7:16 PM
To: angelinahavens@co.imperial.ca.us; BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C; garywyatt@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; "jchilders@blm.gov."@mail3.blm.gov; johnrenison@co.imperial.ca.us; juanita.salas@mail.house.gov; mkelley@co.imperial.ca.us; nora.may@mail.house.gov; raycastillo@co.imperial.ca.us
Subject: FW: Emailing: WindSpeedStudyOcotillo.pdf

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons.
Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259
jhpelley@hughes.net

Proposed Ocotillo Wind Mill Project

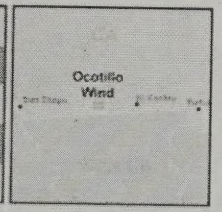


Fact Sheet

Ocotillo Express Wind Project

January 2011

Owner	Pattern Energy Group LP	Phase I Target Construction Start	September 2011
Location	Ocotillo, Imperial County, California	Phase I Target Operation Start	December 2012
Number of Turbines	112	Permanent Jobs	up to 28
Project Capacity	550 MW (Phase 1: 299 MW)	Construction Jobs	up to 250
Power Generation	1,691,000 tonnes	Estimated Annual Tax Revenue	Millions each year



The electricity produced annually by the Pattern's Imperial Valley wind project compared to coal-fired generation would offset more than 1,691,000 tons of carbon dioxide, equal to the annual emissions of more than 270,000 cars, and conserve nearly 1,016,550,000 gallons of water each year, enough to supply 31,000 people with freshwater each day. - Source: AWEA

The Bureau of Land Management (BLM) El Centro District Office published the Notice of Intent to prepare an Environmental Impact Statement for Pattern's Imperial Valley wind energy project in the Federal Register on December 13, 2010. During the public scoping process for the wind project, the BLM will host public meetings to provide the community with opportunities to meet the project team, learn more about the proposed project and the permitting process, and allow the public to ask questions and provide comments about the project.

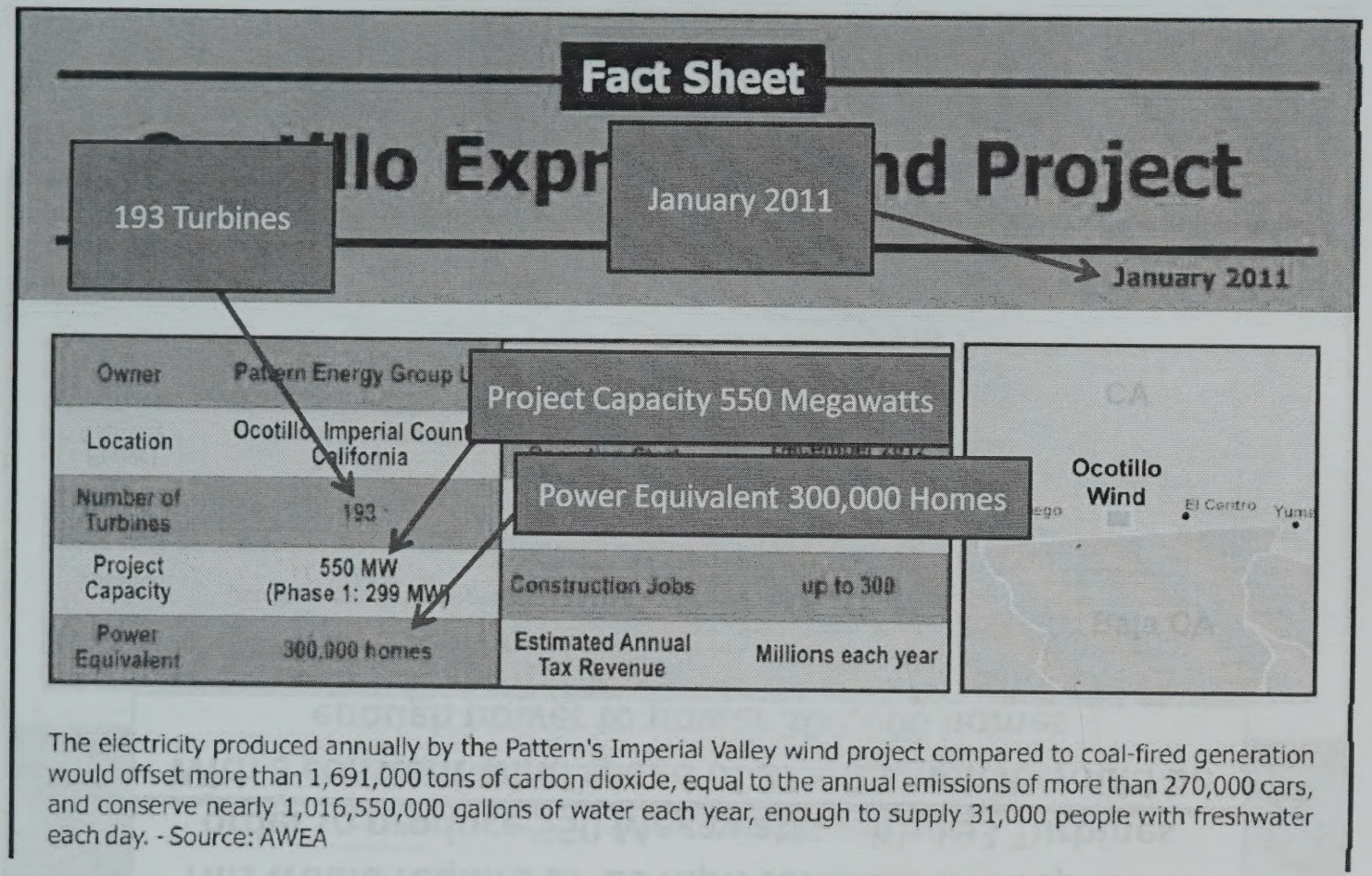
Comments about the project may also be submitted to BLM Project Manager Cedric Perry by e-mail, caocotillo@blm.gov, or regular mail: California Desert District Office, 22835 Calle San Juan de Los Lagos, Moreno Valley, CA 92553. Project documents will be available on the BLM El Centro Field Office's website, http://www.blm.gov/ca/st/en/fo/elcentro.html.

Pattern's project will be Imperial Valley's first wind energy project and it is expected to begin generating electricity by the end of 2012. The proposed 550 MW project will be located almost entirely on BLM administered lands near Ocotillo in Imperial County and will be constructed in two phases. Once complete, the project will produce clean and renewable power equivalent to the annual energy needs of approximately 300,000 California homes.

In addition to providing renewable energy for Californians, Pattern's wind project will create many economic development benefits for the Imperial Valley region, including the creation of construction and ongoing permanent employment positions, substantial growth in the property tax base, and the economic ripple effect resulting from the project.

The 550-MW wind energy facility would be located on approximately 15,000 acres of public lands administered by the BLM and Imperial County. The total disturbed area including temporary disturbance during construction will be approximately 1,290 acres, and the permanent footprint will be approximately 142 acres, which is approximately 1% of the total project area.

Pattern

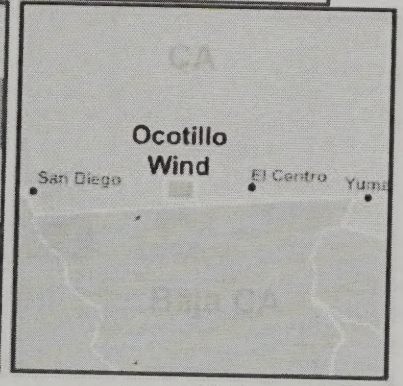


The electricity produced annually by the Pattern's Imperial Valley wind project compared to coal-fired generation would offset more than 1,691,000 tons of carbon dioxide, equal to the annual emissions of more than 270,000 cars, and conserve nearly 1,016,550,000 gallons of water each year, enough to supply 31,000 people with freshwater each day. - Source: AWEA

P340-01

Simple Math:
550mw divided by 193 Turbines = 2.8mw per Turbine
This would require 27-29 mph constant wind speed in order to produce 550 Megawatts with 193 Turbines
With a constant wind speed of 27 – 29 mph it would be enough power to power 300,000 homes

Owner	Pattern Energy Group LP	Phase I Target Construction Start	September 2011
Location	Ocotillo, Imperial County, California	Phase I Target Operation Start	December 2012
Number of Turbines	193	Permanent Jobs	up to 20
Project Capacity	550 MW (Phase 1: 299 MW)	Construction Jobs	up to 300
Power Equivalent	300,000 homes	Estimated Annual Tax Revenue	Millions each year



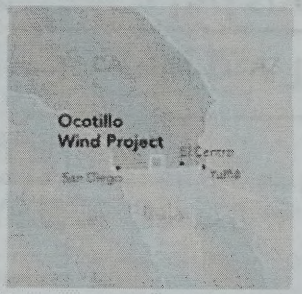
The electricity produced annually by the Pattern's Imperial Valley wind project compared to coal-fired generation would offset more than 1,691,000 tons of carbon dioxide, equal to the annual emissions of more than 270,000 cars, and conserve nearly 1,016,550,000 gallons of water each year, enough to supply 31,000 people with freshwater each day. - Source: AWEA

P340-01, cont.

Ocotillo Wind

Fact Sheet / August 2011

Location	Ocotillo, Imperial County, California
Number of Turbines	155
Project Capacity	465 MW
Power Equivalent	140,000 homes
Target Construction Start	Early 2012
Target Operation Start	December 2012
Permanent Jobs	up to 30
Construction Jobs	up to 300
Estimated Tax Revenue	Several million dollars per year



The electricity produced annually by the Ocotillo wind project compared to coal-fired generation would offset nearly 1,400,000 tons of carbon dioxide, equal to the annual emissions of more than 229,000 cars, and conserve more than 860,000,000 gallons of water each year, enough to supply 26,000 people with freshwater each day. - Source: AWEA

The proposed Ocotillo wind project would be Imperial Valley's first wind energy facility and located on approximately 12,436 acres of public lands mostly administered by the BLM. A small portion of the project is located on lands under the jurisdiction of Imperial County. Once complete, the permanent footprint will be approximately 1% of the total project area.

Pattern's Ocotillo wind project will produce abundant clean and renewable energy equivalent to the annual energy needs of approximately 140,000 California homes. The Project will also create many economic development benefits for the Imperial Valley region, including the creation of construction and ongoing permanent employment positions, substantial growth in the property tax base, and the economic ripple effect resulting from the project.

The BLM and Imperial County have prepared a joint draft California Desert Conservation Area Plan Amendment and draft Environmental Impact Statement/Environmental Impact Report to analyze the site-specific impacts of the proposed project. The document may be viewed online at http://blm.gov/jqjd and analyzes the site-specific impacts on air quality, biological resources, cultural resources, water resources, geological resources and hazards, land use, noise, and visual resources.

Public comments will be accepted until October 5, 2011 and may be sent to Cedric Perry, BLM Project Manager, by mail: 22835 Calle San Juan De Los Lagos, Moreno Valley, CA, 92553; phone: (951) 697-5388; or email cperry@blm.gov.

Pattern

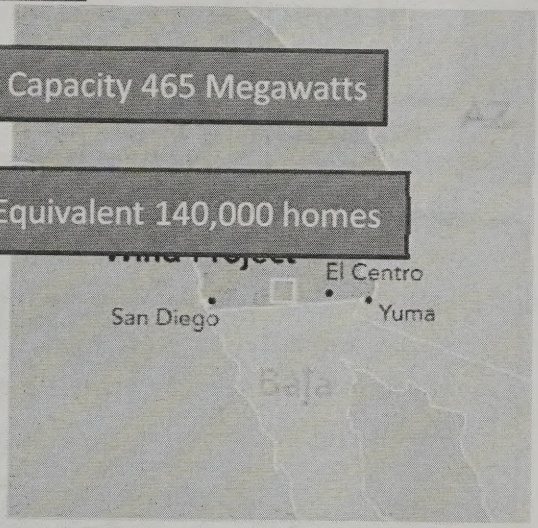
Fact Sheet / August 2011

Location	Ocotillo, Imperial County, California
Number of Turbines	155
Project Capacity	465 MW
Power Equivalent	140,000 homes
Target Construction Start	Early 2012
Target Operation Start	December 2012
Permanent Jobs	up to 30
Construction Jobs	up to 300
Estimated Tax Revenue	Several million dollars per year

155 Turbines

Project Capacity 465 Megawatts

Power Equivalent 140,000 homes



The electricity produced annually by the Ocotillo wind project compared to coal-fired generation would offset nearly 1,430,000 tons of carbon dioxide, equal to the annual emissions of more than 229,000 cars, and conserve more than 860,000,000 gallons of water each year, enough to supply 26,000 people with freshwater each day. - *Source: AWEA*

465mw divided by 155 Turbines = 3.0 mw per Turbine

This would require 27 – 28 mph constant wind speed in order to produce 465 Megawatts with 155 Turbines

With a constant wind speed of 27 mph it would be enough power to power 140,000 homes

P340-02

Comment Letter P340

EXECUTIVE SUMMARY

ES.1 Background and Project Overview

The Draft Plan Amendment (PA) and Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) analyzes the impacts of Ocotillo Express LLC's (Applicant) Ocotillo Wind Energy Facility (OWEF). The application for this project was filed with the Bureau of Land Management (BLM) as an Application for a Right-of-Way (ROW) authorization to construct, operate, maintain, and decommission, an approximate 12,436-acre, up to 465-Megwatt (MW) wind energy project including a substation, administration, operations and maintenance facilities, transmission, and temporary construction lay down areas (CACA, 51552). The *Regional Context* for the proposed OWEF is shown in Figure 1-1 (See Appendix A for all figures referenced in the Draft PA and Draft EIS/EIR). The *Proposed OWEF Site Layout* is shown in Figure 2.3-1. This Draft PA and Draft EIS/EIR present the potential effects of the OWEF and alternatives on BLM-administered lands and other affected lands and resources. In this analysis, six alternatives, including the proposed OWEF or Proposed Action, were developed and evaluated. These include

- The Proposed Action - 155 Wind Turbine Generators (Alternative 1);
- 137 Wind Turbine Generators Alternative (Alternative 2);
- 105 Wind Turbine Generators Alternative (Alternative 3);
- No issuance of a ROW grant or County approval/No Land Use Plan (LUP) Amendment (Alternative 4);
- No issuance of a ROW grant or County approval/Approval of a land use plan amendment to exclude wind energy development on the site of the Proposed Action (Alternative 5); and
- No issuance of ROW grant or County approval/Approval of a land use plan amendment to make site available for future wind energy development (Alternative 6).

The Applicant proposes to construct, operate, maintain, and decommission the proposed OWEF, an up to 465- MW wind energy facility on approximately 12,436 acres in Imperial County, California, near the unincorporated community of Ocotillo. The project would be located on BLM-administered land except for approximately 26 acres of private land near the center of the proposed OWEF site. Additionally, 487 acres of private and public land outside the project boundaries would be utilized for road access and collection line ROWs.

Proposed Action (Alternative 1)

The proposed OWEF (Alternative 1) consists of the construction, operation, maintenance, and decommissioning of wind turbine generators (WTGs) and associated facilities necessary to successfully generate up to 465 MW of electrical energy. A proposed total of 155 WTGs would be located on the project site. The proposed OWEF would be constructed in two phases. Phase I is anticipated to total approximately 315 MW, with the installation of up to 137 WTGs using turbines ranging from 1.6 to 3 MW in generating capacity. Phase II would include the construction of 18 WTGs (also ranging 1.6 to 3 MW in capacity) generating up to 150 MW, and would likely to be built in the year immediately following completion of Phase I. In order to reach up to the 150-MW capacity in Phase II, there is the

Phase 1
315mw from 137 Wind Turbine
315mw divided by 137windmills = 2.3mw per Wind Turbine
The Wind would have to be blowing 28 mph to generate 315 mw

Proposed Action (Alternative 1)

The proposed OWEF (Alternative 1) consists of the construction, operation, maintenance, and decommissioning of wind turbine generators (WTGs) and associated facilities necessary to successfully generate up to 465 MW of electrical energy. A proposed total of 155 WTGs would be located on the project site. The proposed OWEF would be constructed in two phases. Phase I is anticipated to total approximately 315 MW, with the installation of up to 137 WTGs using turbines ranging from 1.6 to 3 MW in generating capacity. Phase II would include the construction of 18 WTGs (also ranging 1.6 to 3 MW in capacity) generating up to 150 MW, and would likely to be built in the year immediately following completion of Phase I. In order to reach up to the 150-MW capacity in Phase II, there is the

P340-03

150mw from 18 Wind Mills
150mw divided by 18windmills = 8.3mw per Wind Turbine
8.3mw per Wind Mill??? Max output is 3.0 mw per wind turbine
18 Wind Turbines times 3.0mw = 54 mw

They state that they will be using a Wind Turbine that is ranging between 1.6 mw to 3.0 mw

Pattern told us this was the Wind Mill Model number they were going to use

Siemens Wind Turbine SWT-2.3-101

- Description
- Technical Specification
- Design

This Model produces ***up to*** 2.3 mw

High availability

Currently, the Siemens fleet of 2.3 MW wind turbines sets the industry standard for availability. The SWT-2.3-101 will build on the reputation for reliability that the market has come to expect from a Siemens turbine.

Harvest more energy from sites with low and medium wind speeds

The Siemens SWT-2.3-101 turbine delivers unparalleled performance and reliability, making it especially suited to areas with low to medium wind speeds.

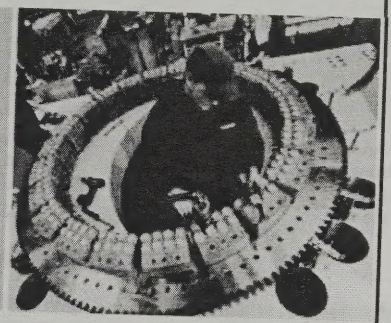
The best-in-class turbine offers low energy production costs, as availability of Siemens' 2.3 product family is among the highest in the industry. The 101 meter rotor is specifically designed to optimize the energy returns in areas with limited wind speeds. The turbine is also ideal for all types of grid connections, as it offers the best support for grid connections in all major markets.

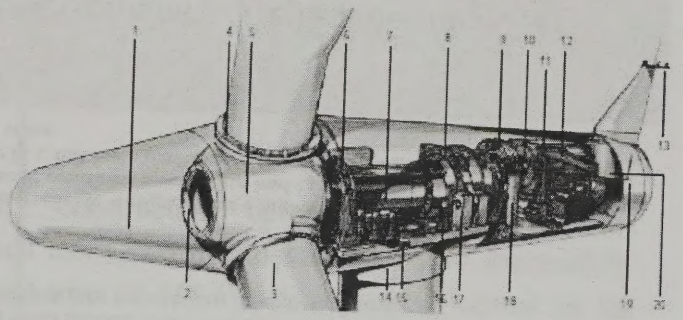
Designed to last

The SWT-2.3-101 is designed to last. The robust and reliable design offers a high yield with low maintenance costs. The turbine is backed by advanced condition monitoring and diagnostics, which constantly examine the turbine. Any change in a turbine's performance is dealt with immediately by an experienced after-sales service team.

Source: http://www.energy.siemens.com/br/en/power-generation/renewables/wind-power/wind-turbines/swt-2-3101.htm

Technical specifications



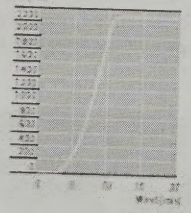


Rotor	
Diameter	101 m
Swept area	8,000 m2
Rotor speed	6-16 rpm
Power regulation	Pitch regulation with variable speed
Blades	
Type	B49
Length	49 m
Aerodynamic brake	
Type	Full-span pitching
Activation	Active, hydraulic
Transmission system	
Gearbox type	3 stage planetary/helical
Gearbox ratio	1:95
Gearbox oil filtering	Inline and offline
Gearbox cooling	Separate oil cooler
Oil volume	Approx mass by 400 l
Mechanical brake	
Type	Hydraulic disc brake
Generator	
Type	Asynchronous
Nominal power	2,300 kW
Voltage	690V
Cooling system	Integrated heat exchanger

Yaw system	
Type	Active
Monitoring system	
SCADA system	WebWTS
Remote control	Full turbine control
Towers	
Type	Cylindrical and/or tapered tubular
Hub height	80 m or site specific
Operational data	
Cut-in wind speed	3.4 m/s
Rated power at	12-13 m/s
Cut-out wind speed	25 m/s
Maximum 3 s gust	59 m/s (standard version) 69 m/s (IEC version)
Weights	
Rotor	67 tons
Nacelle	82 tons
Tower for 80 m hub height	162 tons

Sales power curve

The calculated power curve data are valid for standard conditions at 15 degrees Celsius air temperature, 1013 hPa air pressure and 1.225 kg/m³ air density, clean rotor blades and horizontal, undisturbed air flow. The calculated curve data are preliminary.



Nacelle arrangements

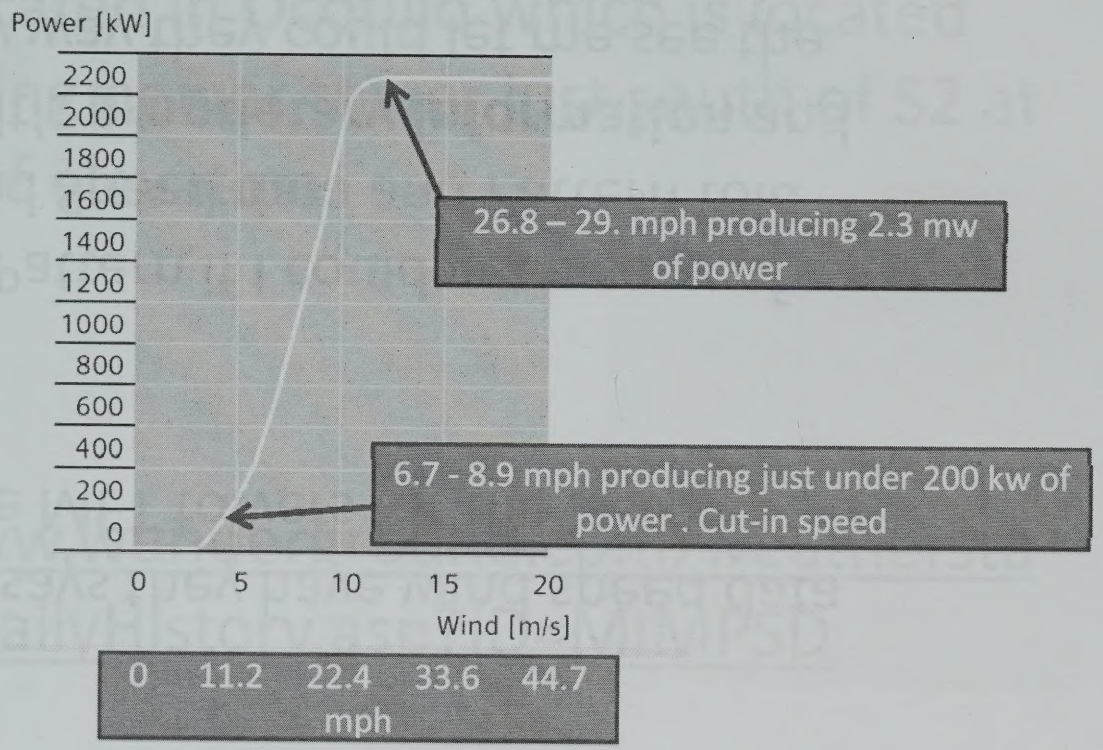
1. Spinner
2. Spinner brackets
3. Blade
4. Pitch bearing
5. Rotor hub
6. Main bearing
7. Main shaft
8. Gearbox
9. Brake disc
10. Coupling
11. Generator
12. Service crane
13. Meteorological sensors
14. Tower
15. Yaw ring
16. Yaw gear
17. Nacelle cladding
18. Oil filter
19. Canopy
20. Generator fan

http://www.energy.siemens.com/hq/pool/hq/power-generation/wind-power/E50001-W310-A121-X-4A00_WS_SWT-2.3-101_US_1009.pdf

Siemens SWT-2.3-101 Specification data

Operational data

Cut-in wind speed	3-4 m/s	←6.7 - 8.9 mph
Rated power at	12-13 m/s	← 26.8 - 29.1 mph
Cut-out wind speed	25 m/s	
Maximum 3 s gust	55 m/s (standard version) 60 m/s (IEC version)	



Pattern says they have wind speed data from the MET towers for the last 2 years

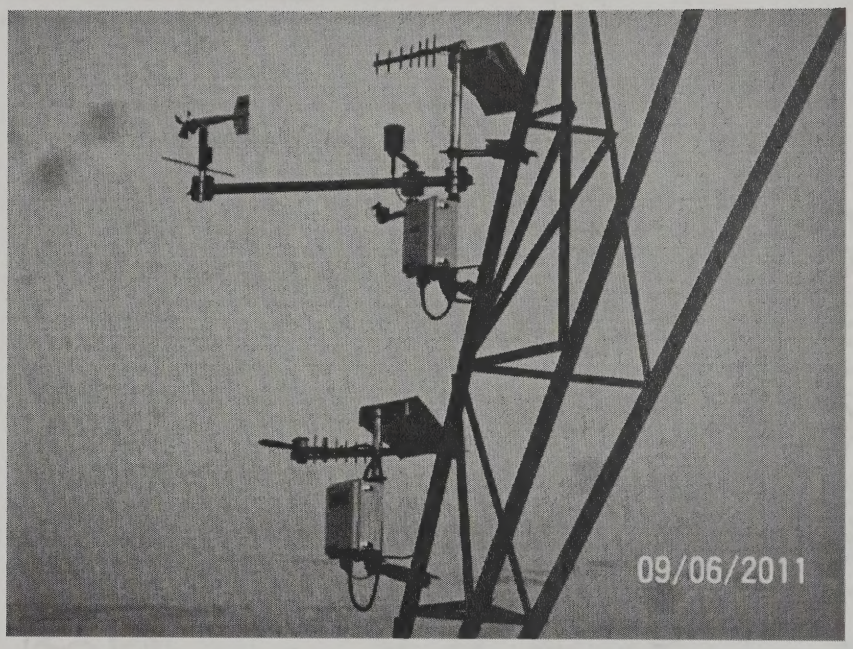
I asked Pattern if I could get a copy of the Wind Speed data and Pattern told me no, it's **proprietary information** and the only way they could let me see the data was if I signed a confidentiality agreement

P340-04

With out having Pattern's data, I did my wind study based on the data from a weather station located in Ocotillo which is located on a existing power tower just south of S2 at 695 feet of elevation:

P340-04, cont.

Website:
http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=MIMPSD



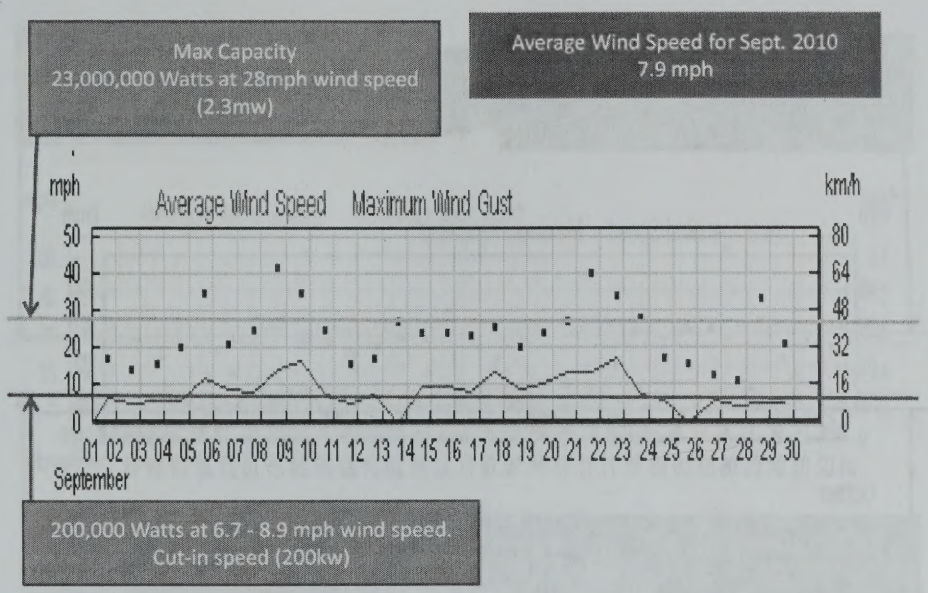
Daily Summary for September 1, 2010 - September 30, 2010

September 1 2010 - TO - September 30 2010 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**110.0** °F	**65.0** °F	**91.0** °F
Dew Point:	**65.0** °F	**-99.9** °F	**36.1** °F
Humidity:	65.0%	3.0%	17.0%
Wind Speed:	**30.0**mph from the SW	-	**7.9**mph
Wind Gust:	**42.0**mph from the SW	-	-
Wind:	-	-	SSW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



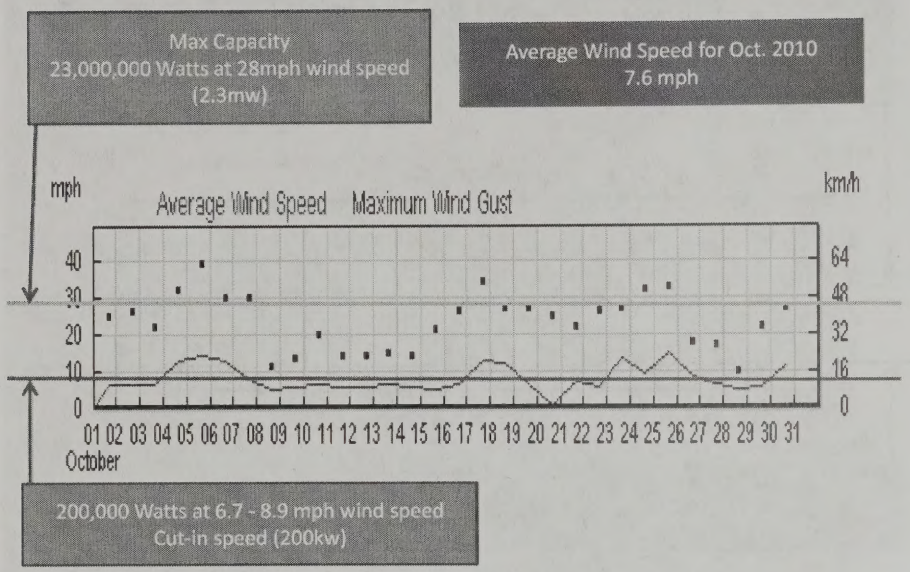
Daily Summary for October 1, 2010 - October 31, 2010

October 1 2010 - TO - October 31 2010 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**96.0** °F	**58.0** °F	**74.8** °F
Dew Point:	**71.0** °F	**-99.9** °F	**43.8** °F
Humidity:	96.0%	10.0%	37.5%
Wind Speed:	**24.0**mph from the SSW	-	**7.6**mph
Wind Gust:	**39.0**mph from the WSW	-	-
Wind:	-	-	SSW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

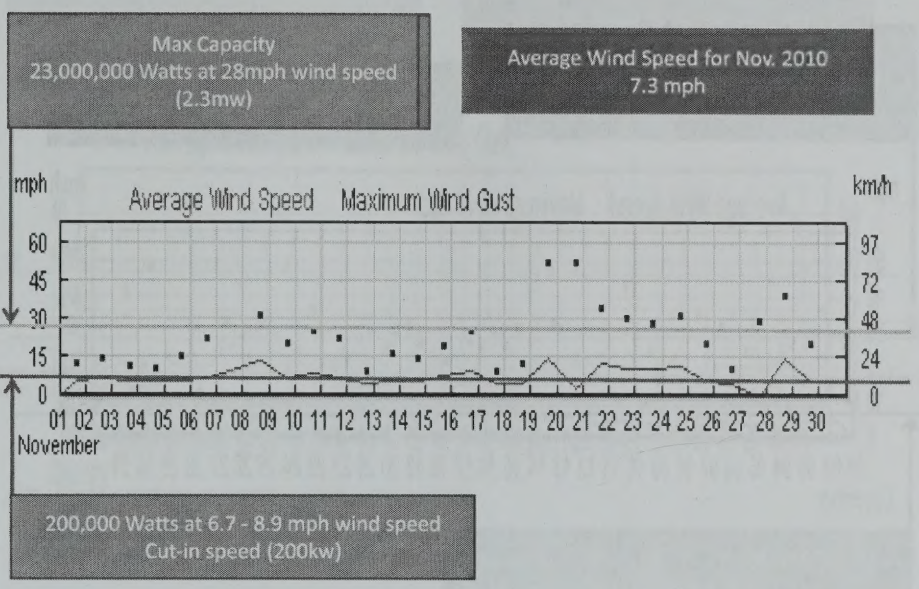
Daily Summary for November 1, 2010 - November 30, 2010

November 1 2010 - TO - November 30 2010 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**91.0** °F	**42.0** °F	**65.6** °F
Dew Point:	**51.0** °F	**-99.9** °F	**29.0** °F
Humidity:	64.0%	7.0%	28.5%
Wind Speed:	**29.0**mph from the SSW	-	**7.3**mph
Wind Gust:	**53.0**mph from the SSW	-	-
Wind:	-	-	SSW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



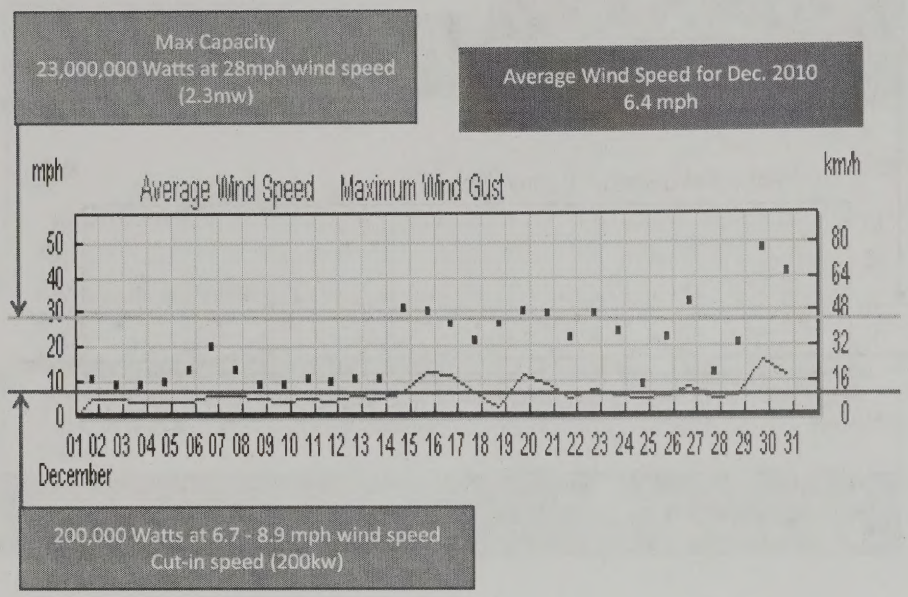
Daily Summary for December 1, 2010 - December 31, 2010

December 1 2010 - TO - December 31 2010 Go

Daily Weekly Monthly Yearly **Custom**

	High:	Low:	Average:
Temperature:	**82.0** °F	**42.0** °F	**62.1** °F
Dew Point:	**57.0** °F	**-99.9** °F	**33.3** °F
Humidity:	98.0%	7.0%	39.3%
Wind Speed:	**32.0**mph from the SW	-	**6.4**mph
Wind Gust:	**48.0**mph from the SW	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

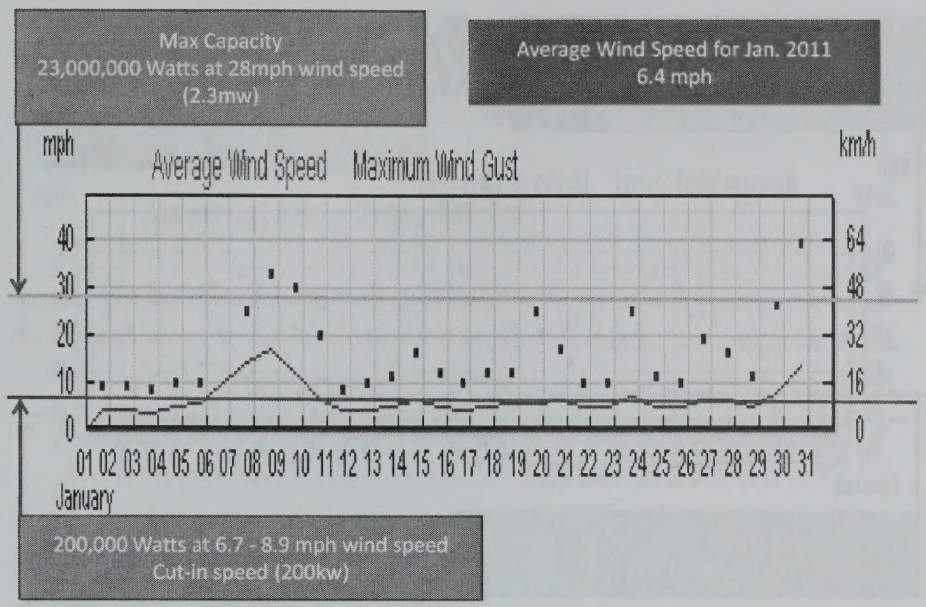
Daily Summary for January 1, 2011 - January 31, 2011

January 1 2011 - TO - January 31 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**89.0** °F	**34.0** °F	**60.5** °F
Dew Point:	**45.0** °F	**-99.9** °F	**24.1** °F
Humidity:	69.0%	7.0%	27.9%
Wind Speed:	**28.0**mph from the SW	-	**6.4**mph
Wind Gust:	**39.0**mph from the SW	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

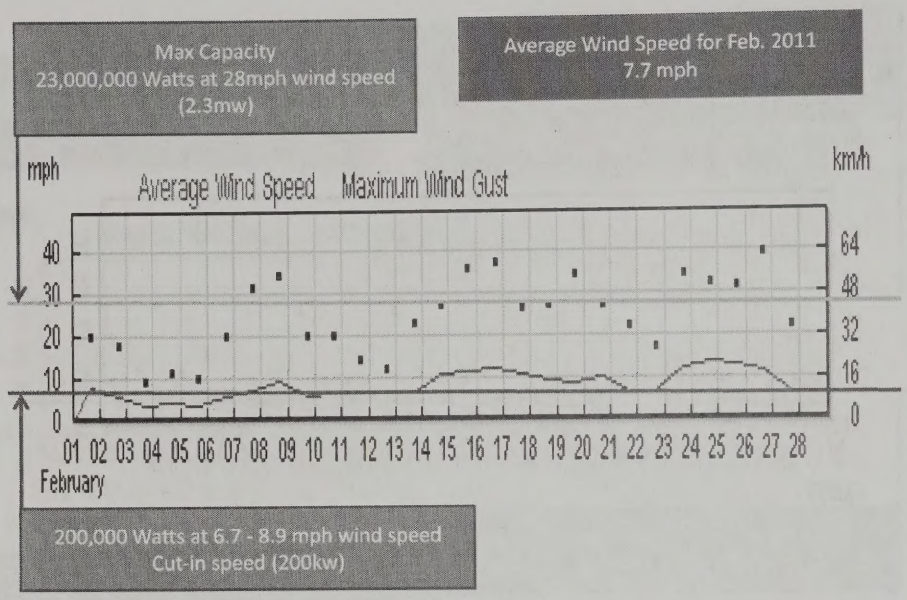
Daily Summary for February 1, 2011 - February 28, 2011

February 1 2011 - TO - February 28 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**78.0** °F	**33.0** °F	**57.4** °F
Dew Point:	**51.0** °F	**-99.9** °F	**23.2** °F
Humidity:	98.0%	8.0%	31.9%
Wind Speed:	**24.0**mph from the SW	-	**7.7**mph
Wind Gust:	**39.0**mph from the SSE	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

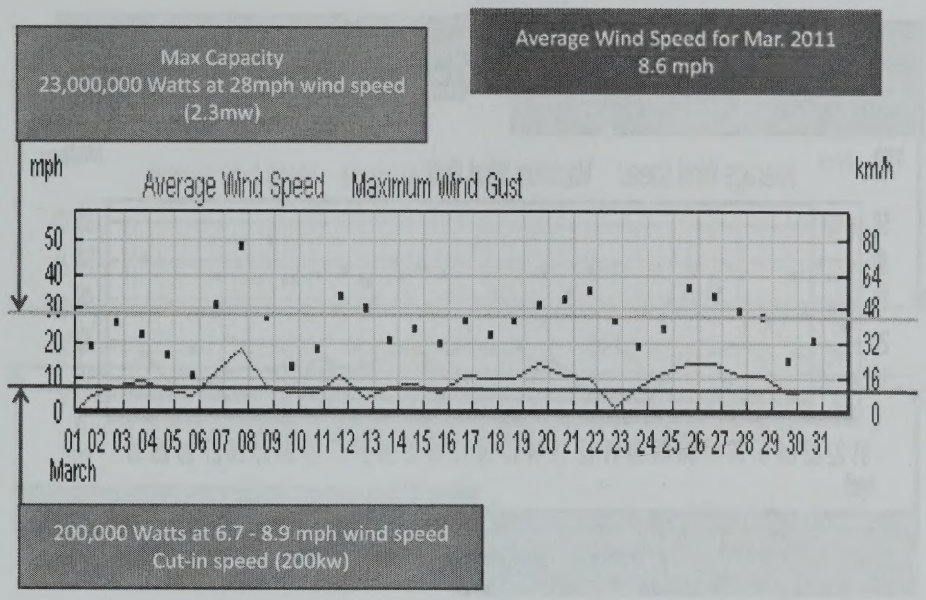
Daily Summary for March 1, 2011 - March 31, 2011

March 1 2011 - TO - March 31 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**95.0** °F	**48.0** °F	**67.9** °F
Dew Point:	**50.0** °F	**-99.9** °F	**31.7** °F
Humidity:	69.0%	5.0%	29.3%
Wind Speed:	**27.0**mph from the West	-	**8.6**mph
Wind Gust:	**48.0**mph from the WSW	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

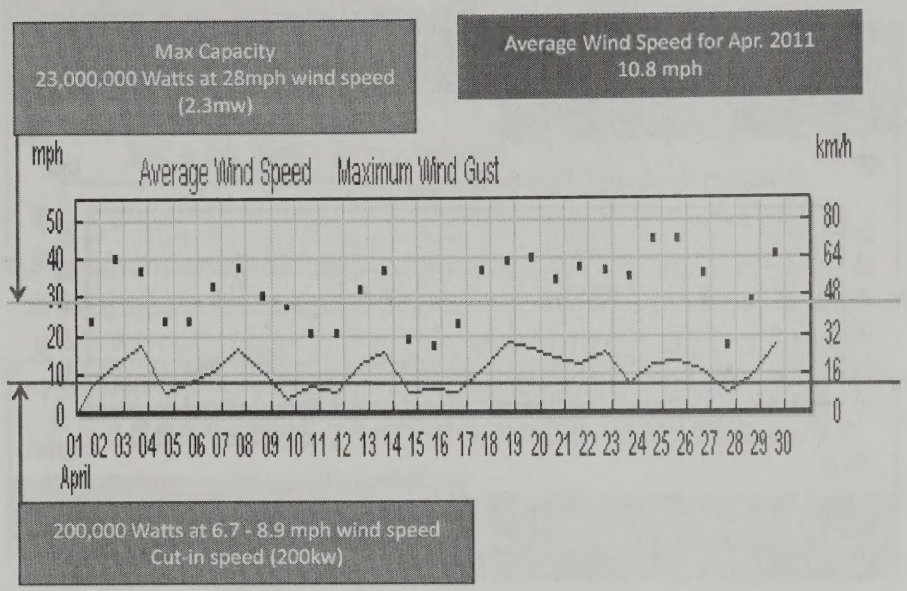
Daily Summary for April 1, 2011 - April 30, 2011

April 1 2011 - TO - April 30 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**99.0** °F	**46.0** °F	**71.9** °F
Dew Point:	**51.0** °F	**-99.9** °F	**30.9** °F
Humidity:	57.0%	4.0%	25.5%
Wind Speed:	**29.0**mph from the SW	-	**10.8**mph
Wind Gust:	**45.0**mph from the WSW	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

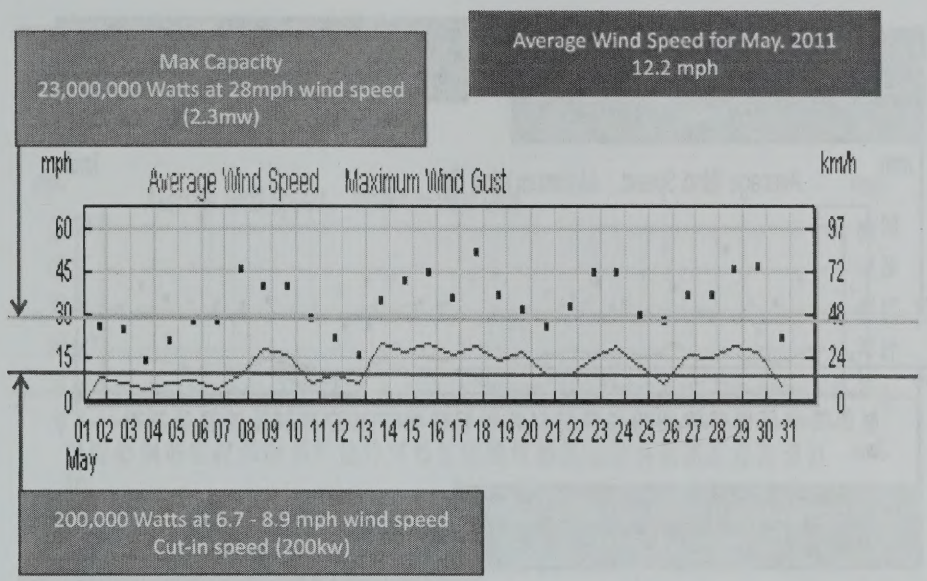
Daily Summary for May 1, 2011 - May 31, 2011

May 1 2011 - TO - May 31 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**100.0** °F	**55.0** °F	**73.9** °F
Dew Point:	**51.0** °F	**-99.9** °F	**30.7** °F
Humidity:	67.0%	5.0%	24.4%
Wind Speed:	**32.0**mph from the SW	-	**12.2**mph
Wind Gust:	**52.0**mph from the West	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

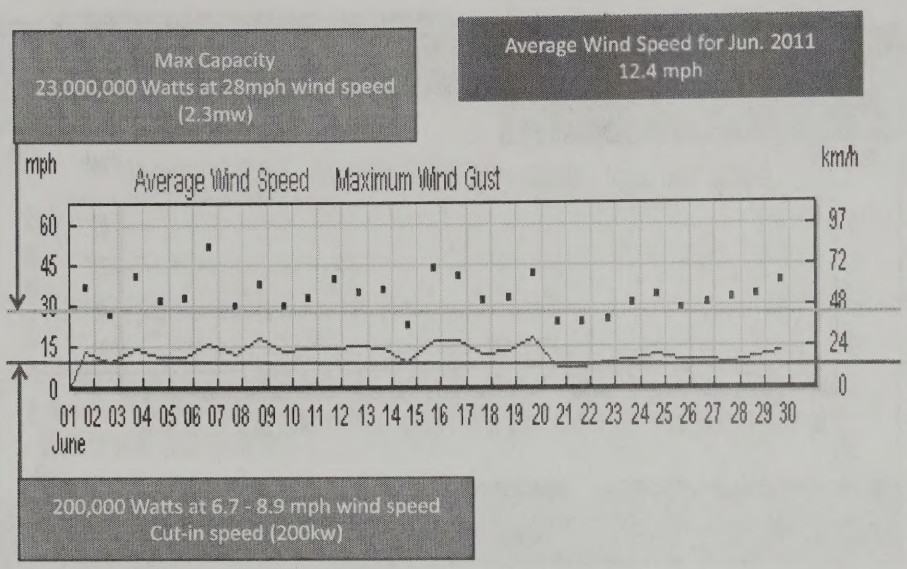
Daily Summary for June 1, 2011 - June 30, 2011

June 1 2011 - TO - June 30 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**110.0** °F	**64.0** °F	**86.6** °F
Dew Point:	**51.0** °F	**-2.0** °F	**32.7** °F
Humidity:	61.0%	4.0%	16.5%
Wind Speed:	**30.0**mph from the SW	-	**12.4**mph
Wind Gust:	**52.0**mph from the SW	-	-
Wind:	-	-	SW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

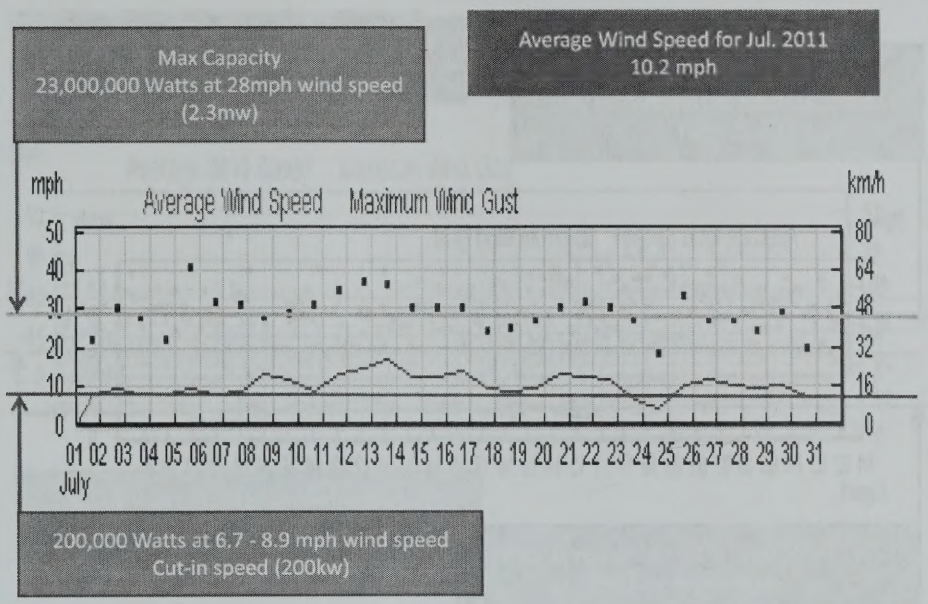
Daily Summary for July 1, 2011 - July 31, 2011

July 1 2011 - TO - July 31 2011 Go

Daily | Weekly | Monthly | Yearly | **Custom**

	High:	Low:	Average:
Temperature:	**112.0** °F	**74.0** °F	**93.1** °F
Dew Point:	**72.0** °F	**4.0** °F	**43.2** °F
Humidity:	76.0%	3.0%	21.1%
Wind Speed:	**26.0**mph from the SW	-	**10.2**mph
Wind Gust:	**41.0**mph from the SW	-	-
Wind:	-	-	SSW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

MIMPSD Weather Graph



History for MIMPSD

Sunrise CA US, Ocotillo, CA — Current Conditions

The data provider for this station: MesoWest

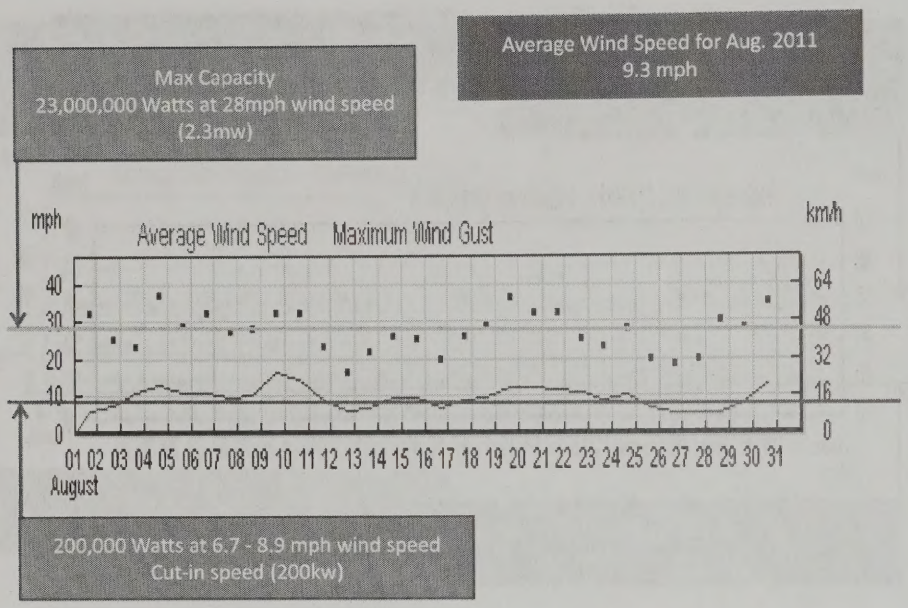
Daily Summary for August 1, 2011 - August 31, 2011

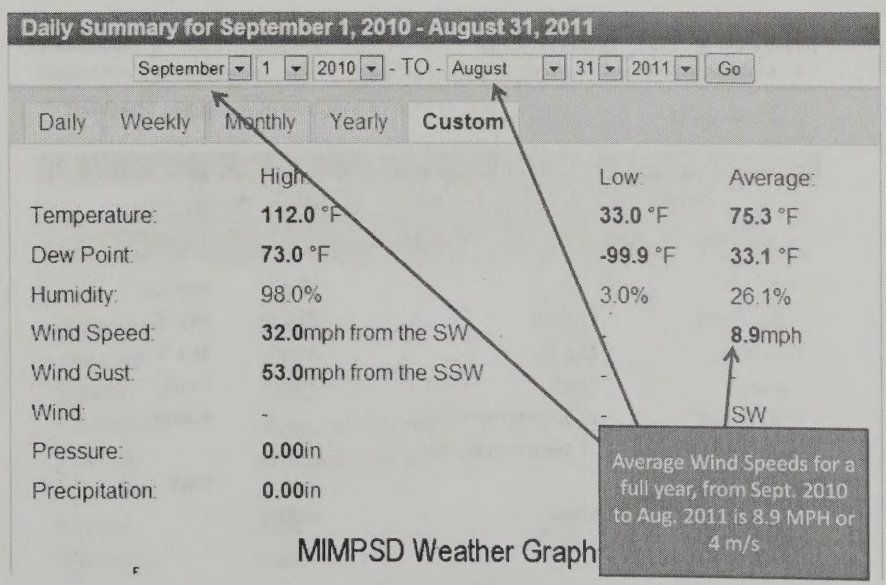
August 1 2011 - TO - August 31 2011 Go

Daily Weekly Monthly Yearly **Custom**

	High:	Low:	Average:
Temperature:	**112.0** °F	**79.0** °F	**96.8** °F
Dew Point:	**73.0** °F	**3.0** °F	**37.5** °F
Humidity:	54.0%	3.0%	14.5%
Wind Speed:	**28.0**mph from the SW	-	**9.3**mph
Wind Gust:	**37.0**mph from the SW	-	-
Wind:	-	-	SSW
Pressure:	**0.00**in	**40.00**in	-
Precipitation:	**0.00**in		

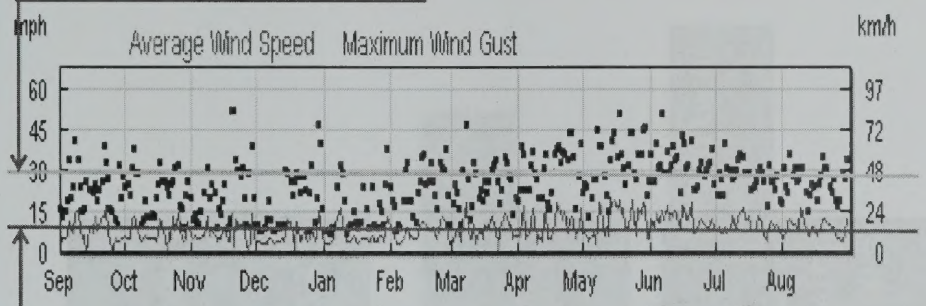
MIMPSD Weather Graph


Max Capacity
23,000,000 Watts at 28mph wind speed
(2.3mw)
Average Wind Speed for Aug. 2011
9.3 mph
mph
Average Wind Speed
Maximum Wind Gust
km/h
40
30
20
10
0
64
48
32
16
0
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
August
200,000 Watts at 6.7 - 8.9 mph wind speed
Cut-in speed (200kw)


Daily Summary for September 1, 2010 - August 31, 2011
September 1 2010 - TO - August 31 2011 Go
Daily Weekly Monthly Yearly Custom
High
Low
Average
Temperature: 112.0 °F 33.0 °F 75.3 °F
Dew Point: 73.0 °F -99.9 °F 33.1 °F
Humidity: 98.0% 3.0% 26.1%
Wind Speed: 32.0mph from the SW 8.9mph
Wind Gust: 53.0mph from the SSW
Wind: SW
Pressure: 0.00in
Precipitation: 0.00in
MIMPSD Weather Graph
Average Wind Speeds for a full year, from Sept. 2010 to Aug. 2011 is 8.9 MPH or 4 m/s

Max Capacity
23,000,000 Watts at 28mph wind speed
(2.3mw)

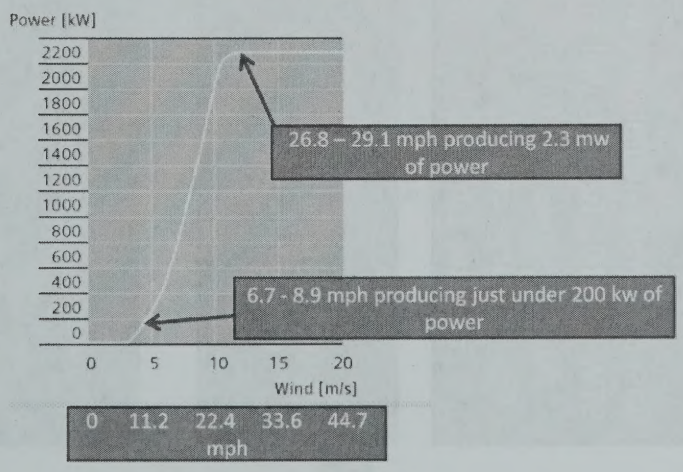
Average Wind Speed for
Sep. 2010 to Aug. 2011
8.9 mph



200,000 Watts at 6.7 - 8.9 mph wind speed
Cut-in speed (200kw)

Siemens SWT-2.3-101 Specification data

Operational data		
Cut-in wind speed	3-4 m/s	←6.7 - 8.9 mph
Rated power at	12-13 m/s	← 26.8 - 29.1 mph
Cut-out wind speed	25 m/s	
Maximum 3 s gust	55 m/s (standard version)	
	60 m/s (IEC version)	



26.8 – 29.1 mph producing 2.3 mw of power

6.7 - 8.9 mph producing just under 200 kw of power

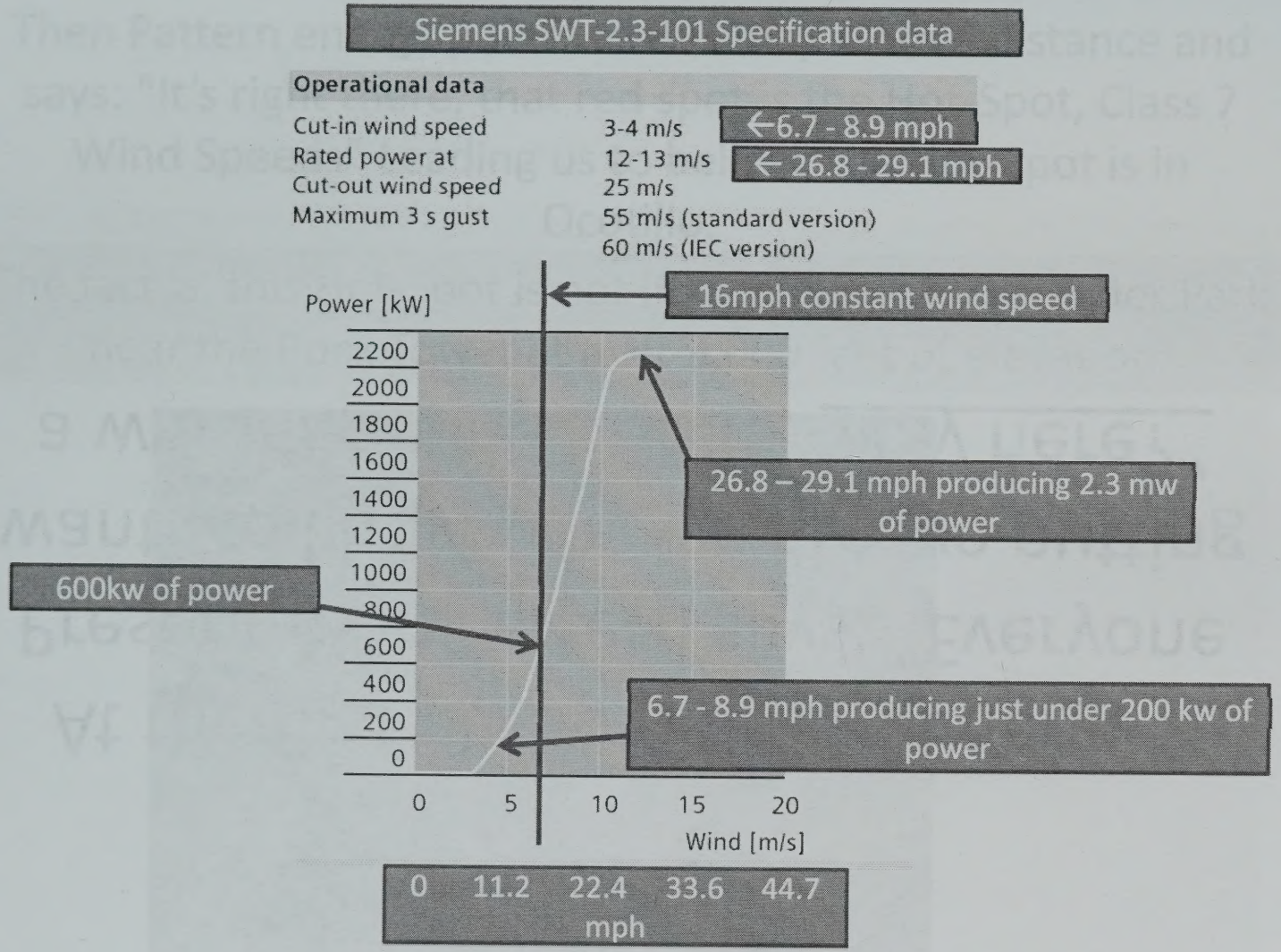
To Summarize

Based on my calculations, with a average wind speed of 8.9 mph the STW-2.3-101 Turbine will produce around 200,000 watts (200kw) of power times 155 turbines = 31mw of total power based on the Power Curve chart. This is enough power to power 23,000 homes, not the 140,000 Pattern is misleading everyone to believe.

Remember, Pattern is basing their calculations on constant 28 mph winds blowing in order to come up with 465 mw of power

If I was to figure 16 mph for and average wind speed the STW-2.3-101 Turbine will produce around 600,000 watts (600kw) of power times 155 turbines=93mw of total power and would be enough power to power 51,000 homes, still a long way from the 140,000 homes Pattern is figuring.

P340-05

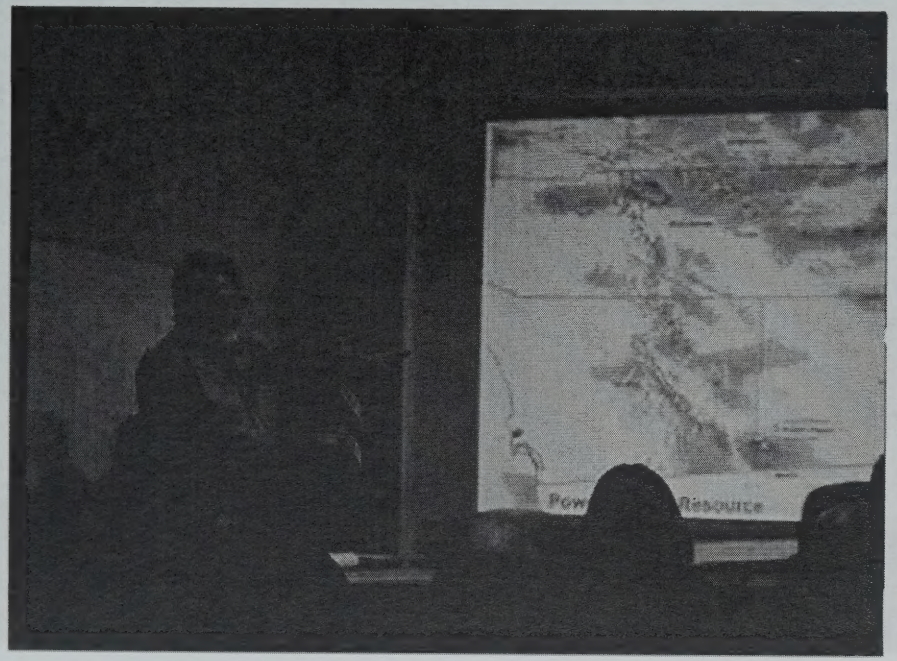

Siemens SWT-2.3-101 Specification data
Operational data
Cut-in wind speed 3-4 m/s
Rated power at 12-13 m/s
Cut-out wind speed 25 m/s
Maximum 3 s gust 55 m/s (standard version)
60 m/s (IEC version)
←6.7 - 8.9 mph
← 26.8 - 29.1 mph
16mph constant wind speed
Power [kW]
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
26.8 – 29.1 mph producing 2.3 mw of power
600kw of power
6.7 - 8.9 mph producing just under 200 kw of power
0 5 10 15 20
Wind [m/s]
0 11.2 22.4 33.6 44.7
mph

At the first part of Pattern Energy's Presentation Pattern says: "Everyone wants to know why we are we putting a wind farm in Ocotillo, Why here?"

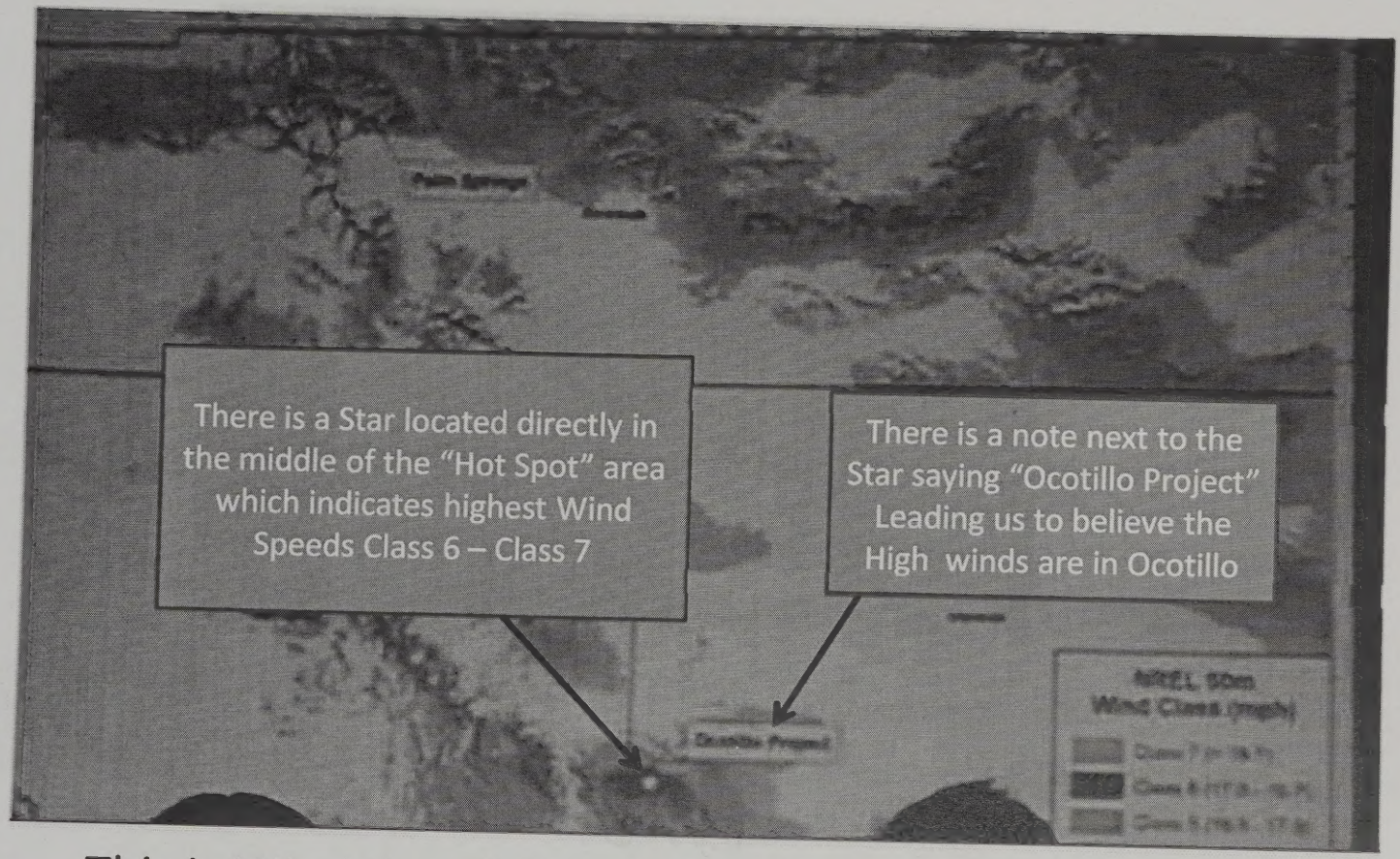
P340-06

Then Pattern energy points to this map from a distance and says: "It's right there, that red spot is the Hot-Spot, Class 7 Wind Speeds" Leading us to believe the Hot-Spot is in Ocotillo.

The fact is, this Hot-Spot is not in Ocotillo, It's in Boulder Park near the Rock Tower at over 3,000 feet of elevation.



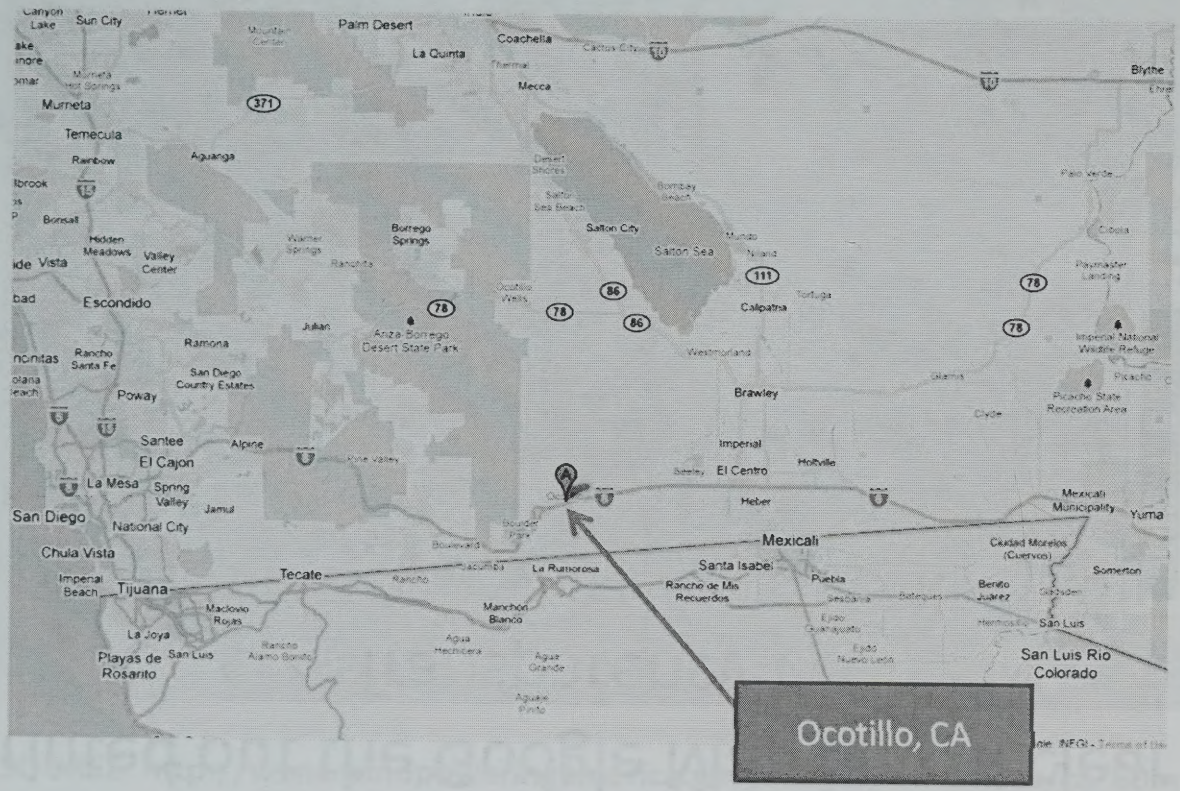
P340-06, cont.



This is Wind Speed Map is from Pattern's Presentation

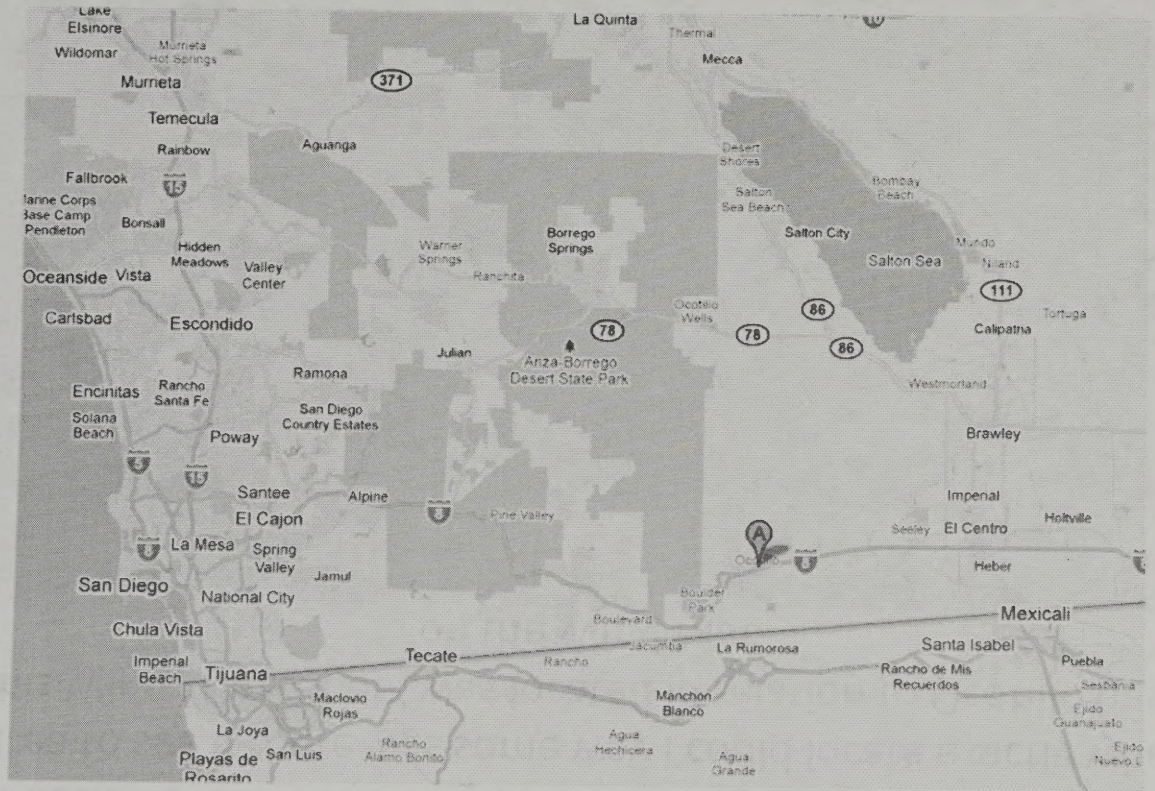
P340-06, cont.

I decided to research this; I used Google Maps to look at this area to see if there was some way I could locate exactly where this Wind "Hot- Spot" was located in relation to Ocotillo based on the Wind Map.



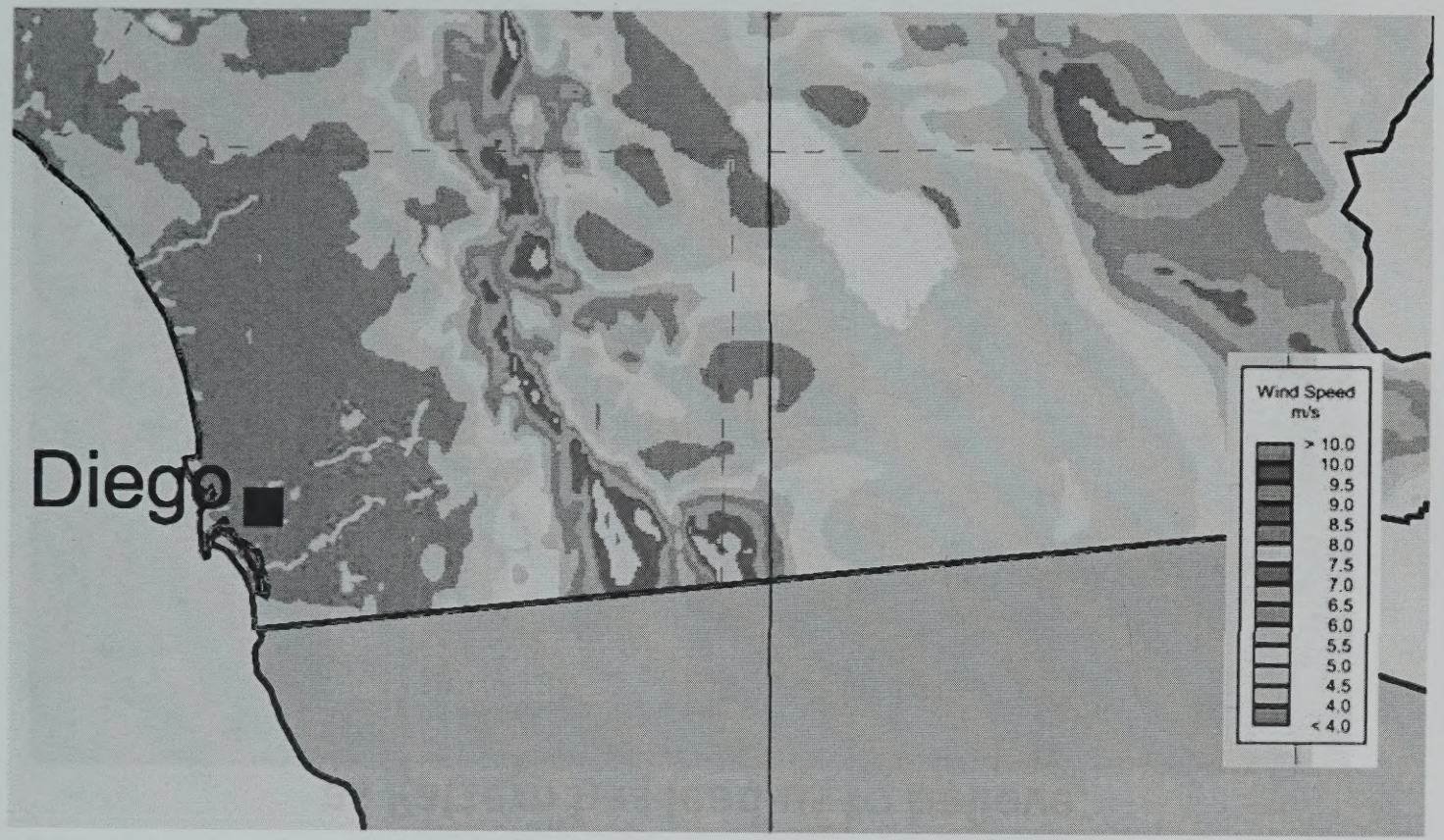
P340-06, cont.

I printed out the Google Map onto a clear Transparency



P340-06, cont.

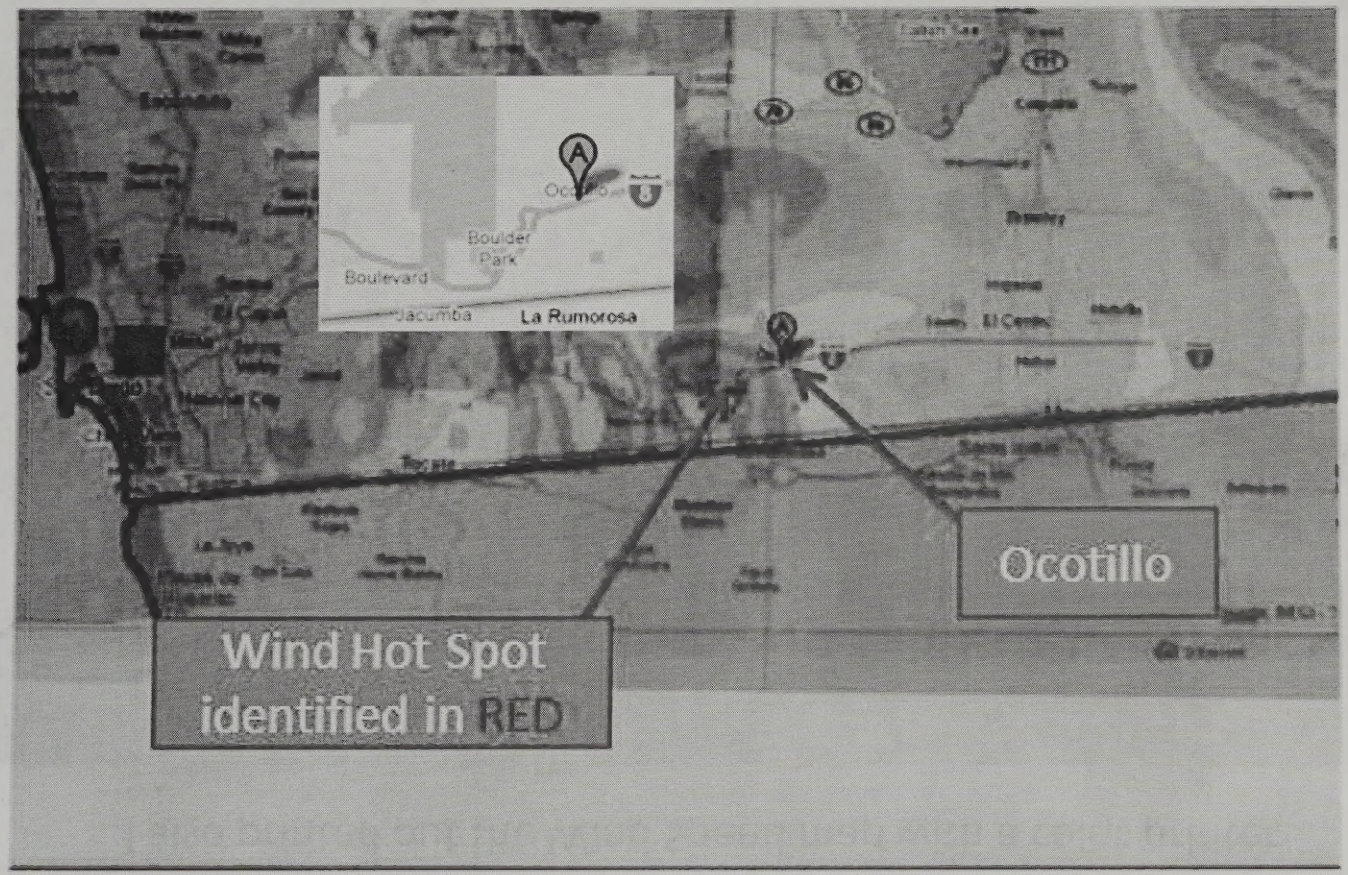
I also printed out the Wind Speed map with a color printer



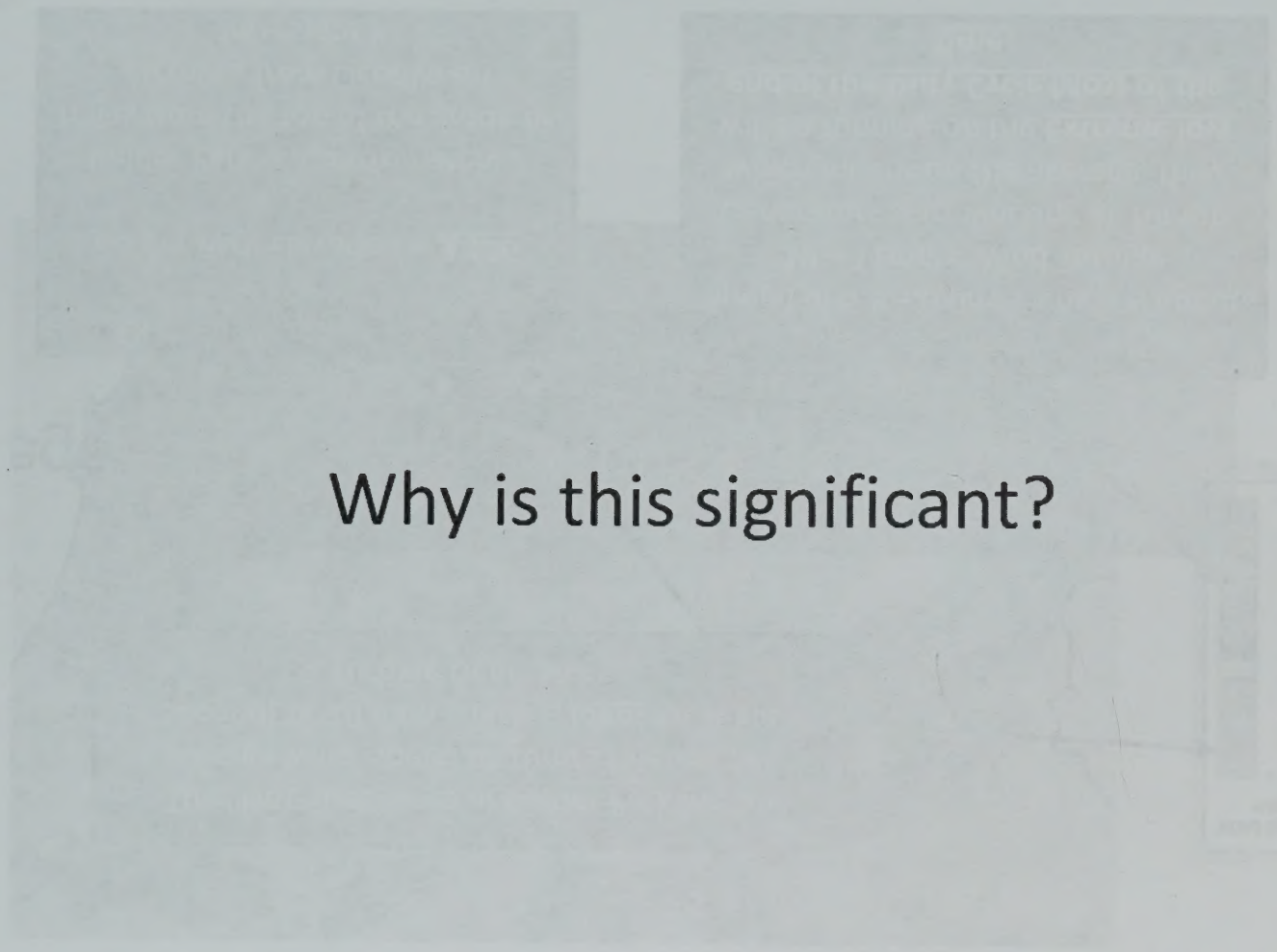
SOURCE: http://www.windpoweringamerica.gov/images/windmaps/ca_80m.jpg

P340-06, cont.

When I zoomed in on the view I noticed that the "Hot-Spot" (RED AREA) is actually at Boulder Park and *NOT* at Ocotillo as Pattern has lead us to believe.

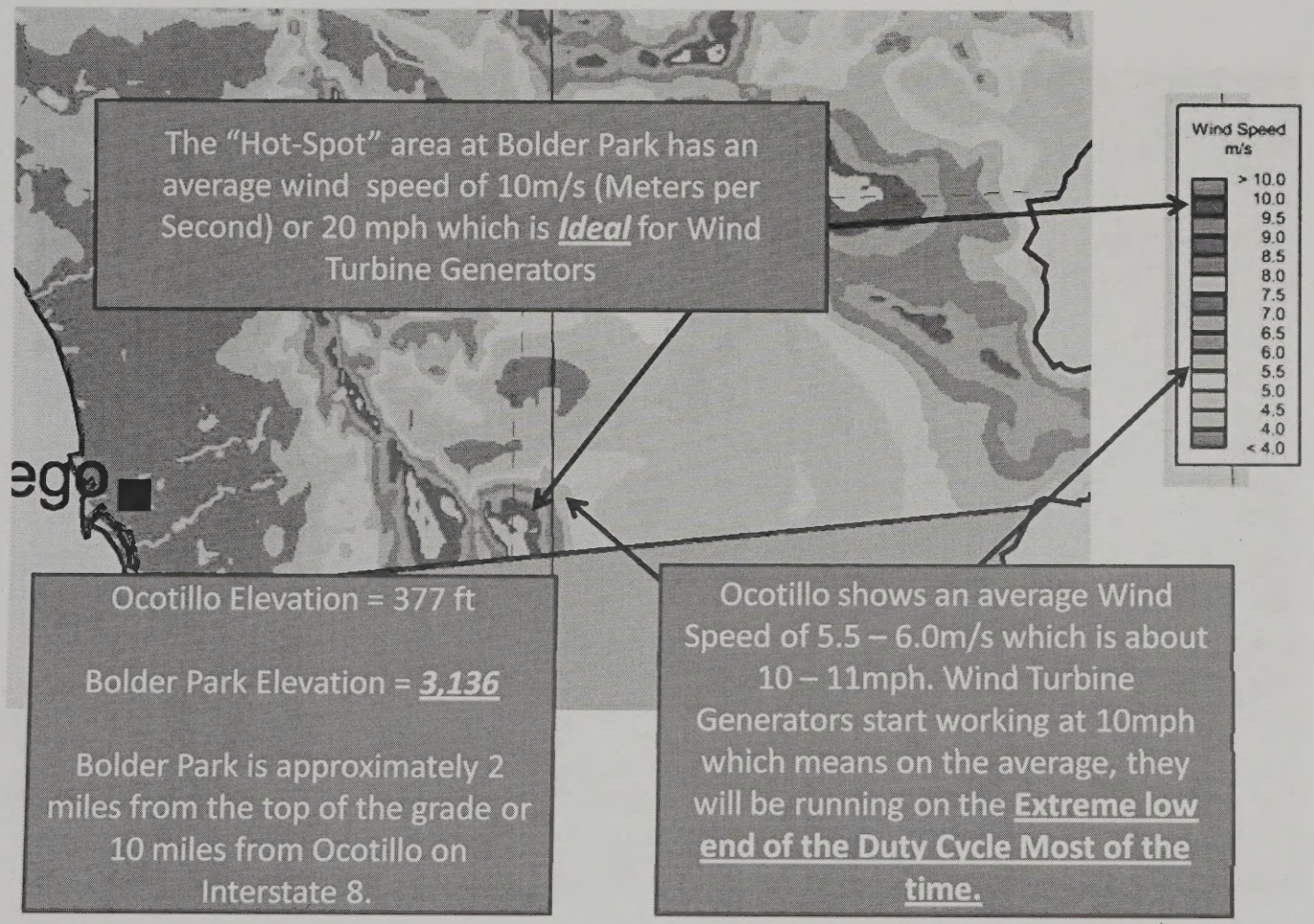


P340-06, cont.

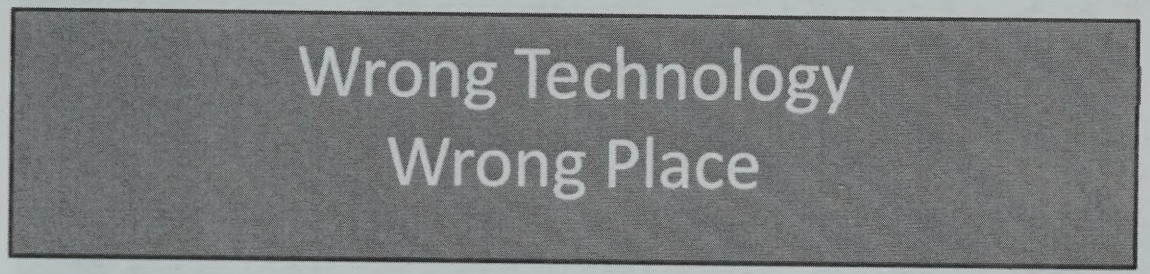


P340-06, cont.

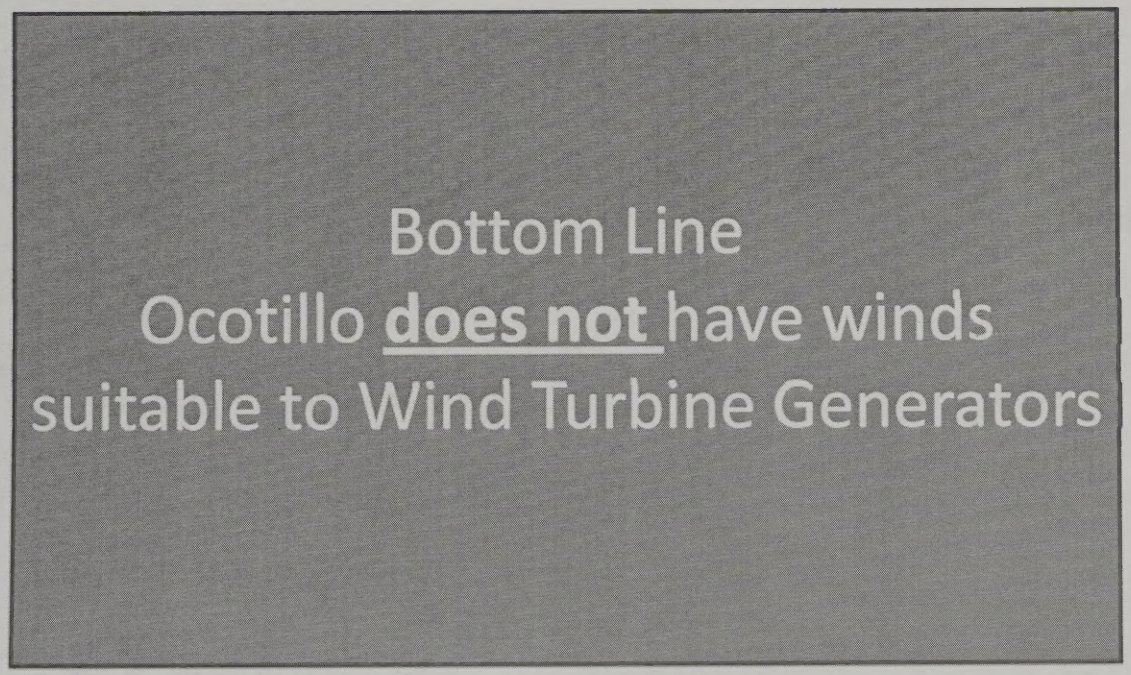
http://www.windpoweringamerica.gov/images/windmaps/ca_80m.jpg



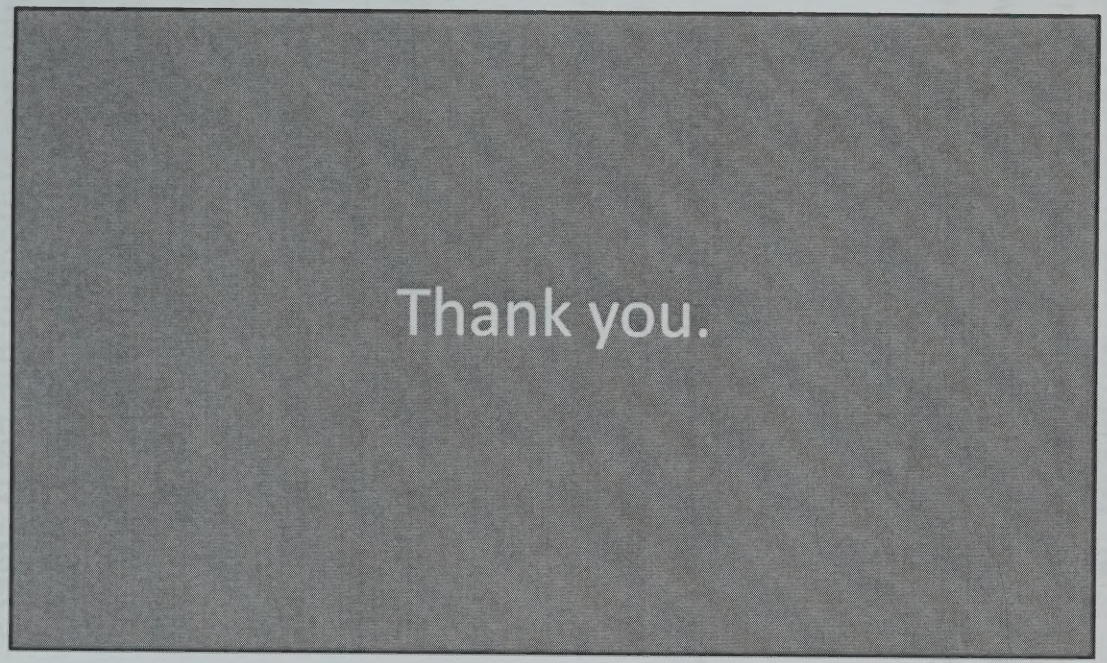
P340-06, cont.



P340-06, cont.


Bottom Line
Ocotillo does not have winds
suitable to Wind Turbine Generators

P340-06, cont.


Thank you.

From: chpelley [mailto:chpelley@hughes.net]
Sent: Tuesday, October 04, 2011 7:18 PM
To: angelinahavens@co.imperial.ca.us; BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C; garywyatt@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; "jchilders@blm.gov."@mail3.blm.gov; johnrenison@co.imperial.ca.us; juanita.salas@mail.house.gov; mkelley@co.imperial.ca.us; nora.may@mail.house.gov; raycastillo@co.imperial.ca.us
Subject: FW: Emailing: PelleyDustnWaterIssues-2.pdf

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons.
Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259
jhpelley@hughes.net

I live on Shell Canyon road, directly east of the Proposed Wind Mill Project.

I am extremely concerned about dust and flooding issues associated with these new projects

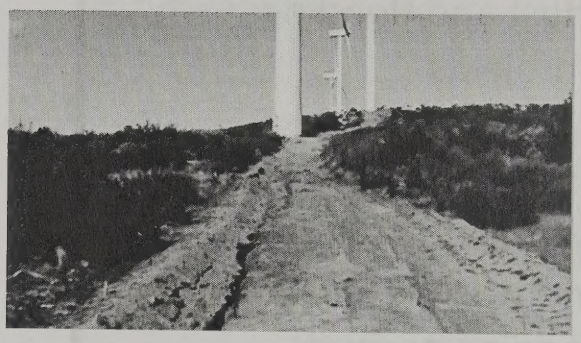
When it rains out here it can rain pretty hard and the natural desert terrain does a very good job of routing the water down to the sand washes and we have never had a problem with flooding or mud

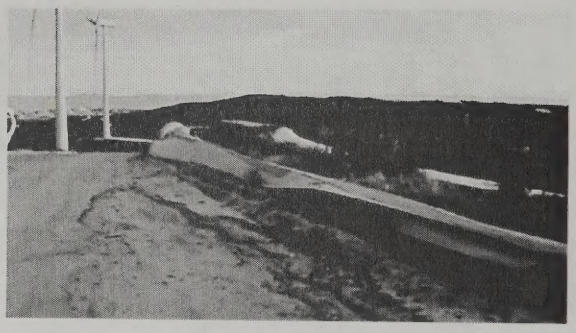
P341-01

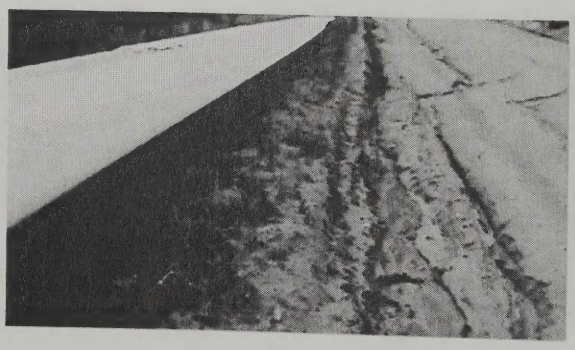
In January of this year I toured the Wind Farm at Golden Acorn to see how they addressed water erosion issues, what I found was alarming.

I presented some of these issues to Pattern and Pattern's response was "On projects we are involved with, we would never allow this to happen."

After further research on this Wind Farm at Golden Acorn, I learned that Pattern was involved with this project in the early stages







The Sunrise Power Link construction has demonstrated the fact that the county and BLM is not policing the project like they promised they would nor are they rarely doing anything about the issues that residents report.

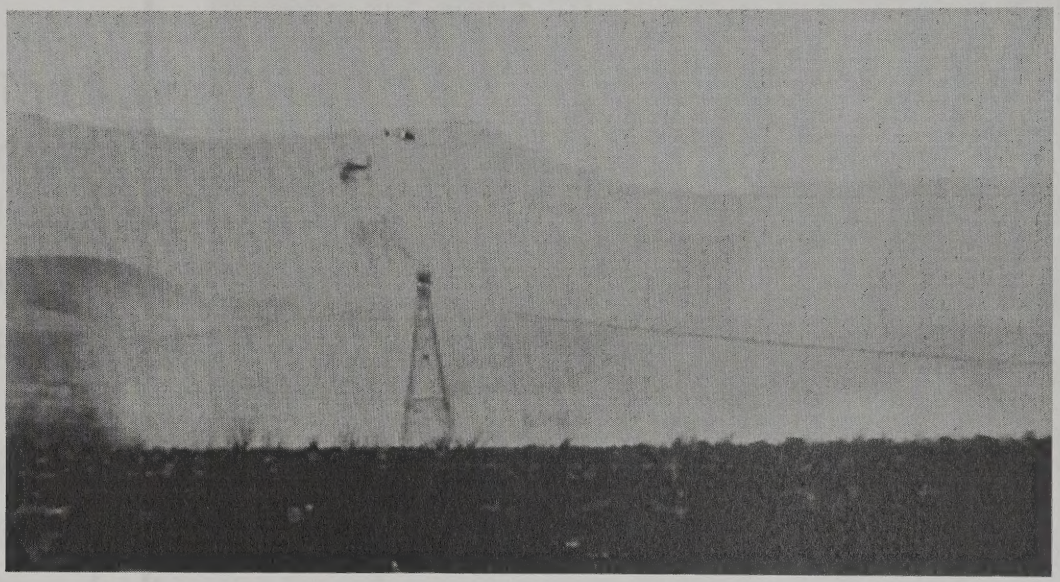
For example, The Sunrise Power Link submitted a dust control plan and said they would control the dust.

P341-02

On Aug. 11, 2011 I called the Air Pollution Control District and reported the dust from the helicopters

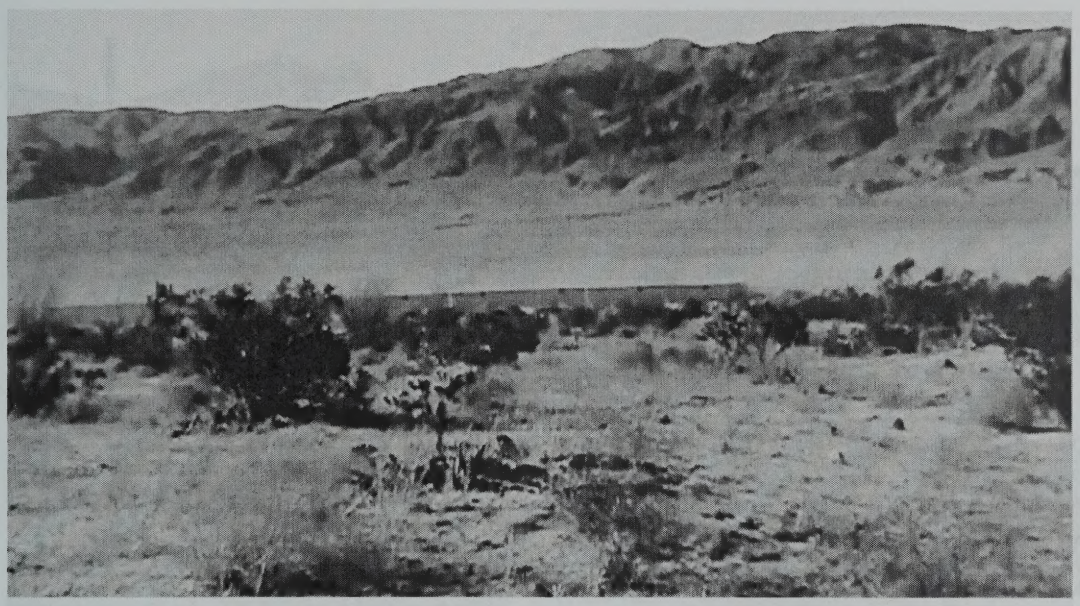
The APCD said they just had a meeting about this with SDG&E and he was very interested in checking it out because SDG&E was pretty much saying there was no problem and they were controlling the dust.

P341-02, cont.



I got a call from the pollution Control District and the guy told me that he thinks SDG&E is in compliance with the Dust control plan they submitted and said that SDG&E had strict rules from BLM to only water the work area where they are working and to not water outside their work area. I explained that the dust was blowing directly from the assembly yard, you could clearly see it. He said if that is the case they are not complying to the plan and said he would try to get back out to investigate, I never heard back from him.

P341-02, cont.

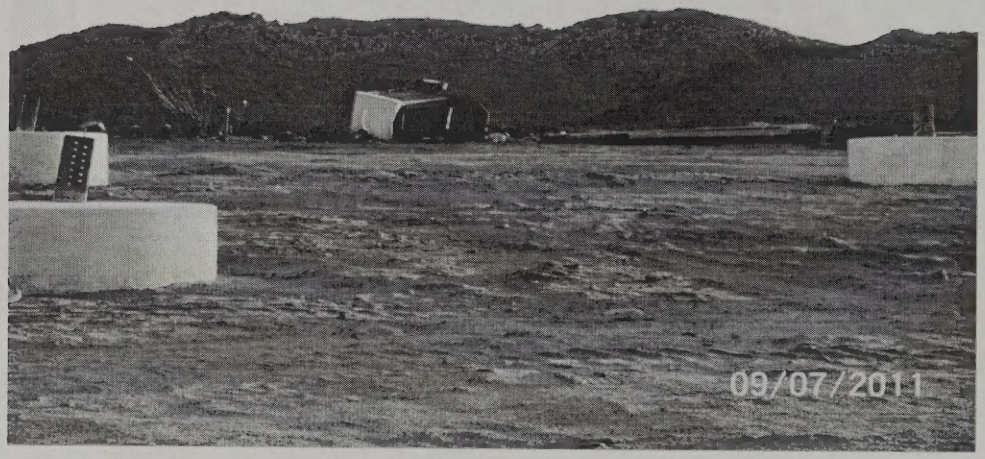


P341-02, cont.

On 6/29/2011 the wind was blowing about 15 mph and dust was clearly blowing out of the assembly yard off S2 and down to my house on Shell Canyon Road

Other environmental issues with the Sunrise Power Link construction.

P341-03



On 9/7/2011 I observed a Port-a-Potty blown over on top of sugar loaf hill and reported it to the Environmental Health Dept.

On 9/8/2011 I drove up to the site and there was workers there parked in trucks next to the Port-a-Potty.

P341-03, cont.

On 9/9/2011, the Port-a-Potty was still leaking Toxic Waste onto the ground.

P341-03, cont.

For at least 4 or 5 days or more this Port-a-Potty was laying on it's side leaking toxic waste onto the ground. I went to the site on 9/12/2011 and the Port-a-Potty was gone but no apparent effort was made to clean up the ground.

P341-03, cont.

The Sunrise Power Link is basically a small project compared to the proposed wind mill project and it's pretty obvious that there is no checks and balances in place to make sure the construction companies are complying with the EIR/EIS they agree to.

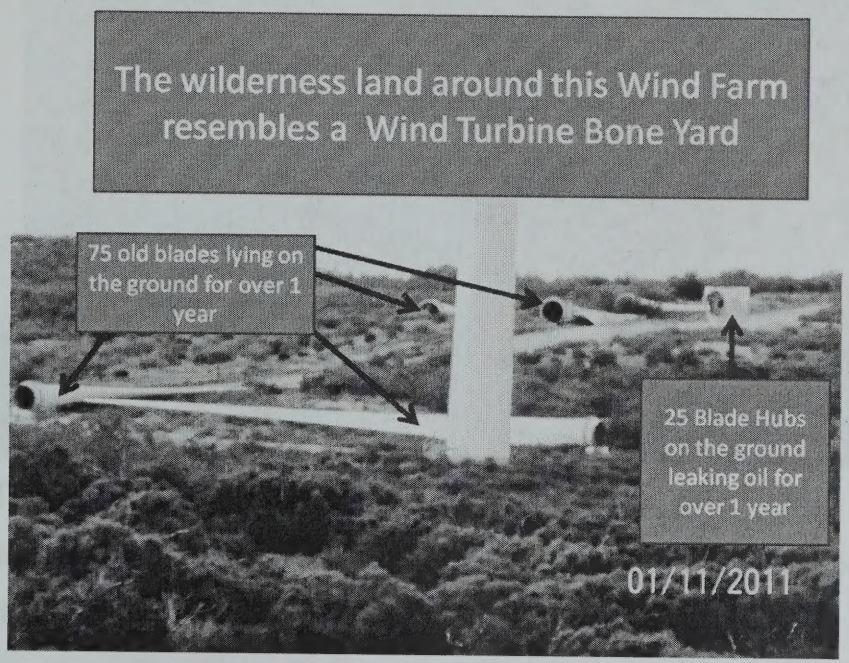
Thank you

From: chpelley [mailto:chpelley@hughes.net]
Sent: Tuesday, October 04, 2011 7:22 PM
To: angelinahavens@co.imperial.ca.us; BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C; garywyatt@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; "jchilders@blm.gov."@mail.den.blm.gov; johnrenison@co.imperial.ca.us; juanita.salas@mail.house.gov; mkelley@co.imperial.ca.us; nora.may@mail.house.gov; raycastillo@co.imperial.ca.us
Subject: FW: Emailing: 06112011meeting.docx

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons.
Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259
jhpelley@hughes.net

Golden Acorn Wind Farm

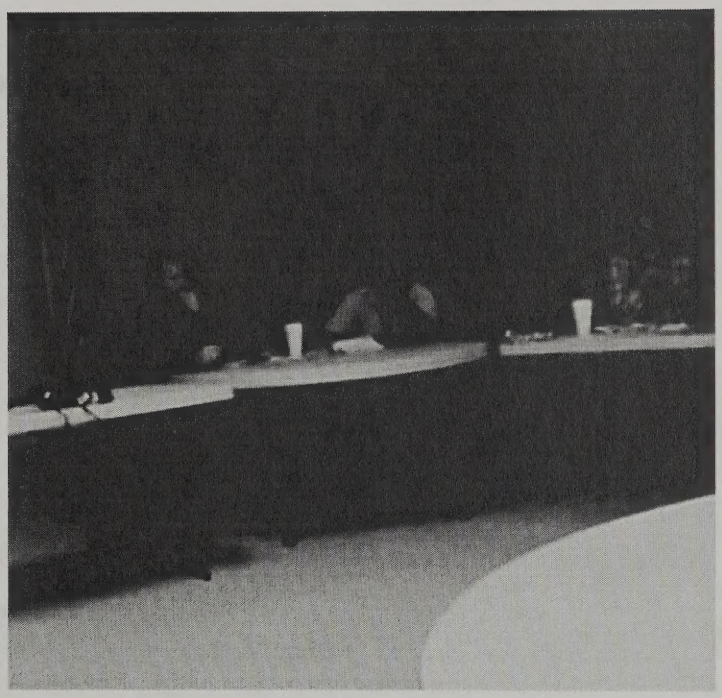
Author: Jim Pelley 6/11/2011



P342-01

01/11/2011

This was brought to Pattern's attention at the last meeting on 1/26/2011. I expressed my concerns about the possibility of this happening on our Federally Protected Aquifer if the project is approved in Ocoitllo.



John from Pattern replied:

"From our perspective, on project we are operating,
"We would not allow something like this to happen"

P342-01, cont.

After showing Pattern the pictures of the toxic waste that has been on the land for over a year at Golden Acorn, Pattern seemed very surprised as if they didn't know anything about it.

As it turns out, Pattern was involved with this project as indicated in Document from SDG&E to the Public Utility Commission dated: March 4, 2011 "ADVICE LETTER 2234-E (U 902-E)"

P342-02

SDGE
A Sempra Energy utility

Clay Faber - Director
Regulatory Affairs
8330 Century Park Court
San Diego, CA 92123-1548

Tel: 858-654-3563
Fax: 858-654-1788
CFaber@semprautilities.com

March 4, 2011

ADVICE LETTER 2234-E
(U 902-E)

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

SUBJECT: REQUEST FOR APPROVAL OF RENEWABLE POWER PURCHASE WITH OCOTILLO EXPRESS, LLC.

I. INTRODUCTION

A. PURPOSE OF THE ADVICE LETTER

San Diego Gas & Electric Company ("SDG&E") seeks approval from the California Public Utilities Commission (the "Commission" or the "CPUC") for a Power Purchase Agreement ("PPA") with Ocotillo Express, LLC ("Ocotillo Express"). The proposed PPA between SDG&E and Ocotillo (the "Proposed Agreement") is for 20 years of wind energy from new plant. Deliveries will begin no later than December 15, 2013.

Page 16 section III-A-1

Shows the following:

2. SUCCESSFUL PROJECTS (RENEWABLE AND CONVENTIONAL)
The Pattern Energy team completed development and placed into commercial operation over 21 wind projects throughout the U.S. since the inception of the RPS Program. These projects include the 50MW Kumeyaay Wind Project in San Diego County, CA, which was the first wind project developed on Native American lands. The Pattern team also developed the 38MW Buena Vista Project in Contra Costs County, CA, the first successful complete repowering of an existing wind project in the Altamont Pass area, replacing old-style turbine technology with modern turbines with much less potential for avian mortality. Significantly, the team completed in 2006 the 300MW Cedar Creek Project in Colorado, which is the same size project proposed for Ocotillo Wind. Most recently, in 2010, the team completed the 101.2MW Hatchet Ridge wind project in Shasta County, California - selling the output to Pacific Gas & Electric.

P342-02, cont.

Perry, Cedric C

From: chpelley <chpelley@hughes.net>
Sent: Tuesday, October 04, 2011 9:08 PM
To: jackterrazas@co.imperial.ca.us; BLM_CA_Ocotillo_Express_Wind_Project; Perry, Cedric C; "'jchilders@blm.gov.'"@mail.den.blm.gov
Cc: raycastillo@co.imperial.ca.us; angelinahavens@co.imperial.ca.us; johnrenison@co.imperial.ca.us; mkelley@co.imperial.ca.us; garywyatt@co.imperial.ca.us
Subject: Ocotillo Wind Energy Project

This email for the opposition of the Proposed Ocotillo Wind Farm in which we strongly oppose for various reasons. Please include me with all of the other opposition concerns.
Resident James and Cheryl Pelley
1362 Shell Canyon road
Ocotillo, Ca 92259

I do suffer from migraine headaches. Which have lessened since moving here. From everything that I have read these turbine will be producing noise and since the desert has not mountains to block the sound I will probably be getting less sleep and when you lose sleep the headaches come more often. Just recently I started to get hives (which I have not had for over 30 years) and it was about the time that SDG&E built their yard over by the Ocotillo Airport up wind from my home and I believe that when they disrupted the ground it stirred up my allergy to something. What is going to happen when Pattern starts disrupting 13,000 acres around my home? **P343-01**

People live here for the peace and quiet of the desert. By placing these giant turbines you are violating our rights and American citizens. You are denying the facts that they do cause health issues as well as the loss of property values. **P343-02**

I object to Ocotillo Wind Energy Project in the Ocotillo community by Pattern. It has been proven that they are not green energy. Pattern has consistently miss-led all of us here in Ocotillo as well as Imperial Valley. When they cannot produce required amount of promised energy another form of energy needs to be used to make up the difference such as a coal fired plant. If the wind farm is **5 miles west of Ocotillo** then why are turbines **not** 5 miles away from the homes? No according to the plans they pretty much will be in our back yards, within a ½ mile. If you are not willing to live with them in your back yard then why should we in Ocotillo have to live with them. Apparently the BLM and Imperial Valley council have not done their entire homework. There is health issues with the wind turbines and since not many have health insurance it will become another bill for Imperial Valley at tax payers cost as well as the state of California. I don't want them and I should not have to be forced by greed of public officials and greedy politician that are only wanting to line their pockets with federal tax money, which I pay. **P343-03**

Ocotillo doesn't have the wind necessary for these giant turbines. The wind does not blow 24/7 which is what is needed to create electricity and it would need to blow at least 20 miles all day long to provide that electricity. This is just a government hoax with no respect to my rights **P343-04**

(**ANOTHER WIND TURBINE SPARKS UP SOUTHWEST ABILINE,** By Denise Blaz SOURCE: Abilene Reporter-News, www.reporternews.com October 3, 2011 (http://betterplan.squarespace.com/)

The Kenneys' appeal — along with an appeal by a second property owner in Amaranth (close to the Melancthon wind farm) — could have far reaching implications for municipal tax coffers in communities hosting wind farms if landowners are granted cuts to their taxes. (**ONTARIO WIND POWER FACES TEST OVER PROPERTY VALUES,** by Dave Seglins and John Nicol, SOURCE CBC News, www.cbc.ca October 4, 2011) (http://betterplan.squarespace.com/) **P343-05**

The government and the wind energy industry have long maintained turbines have no adverse effects on property values, health or the environment. The CBC has documented scores of families who've discovered their property values are not only going downward, but also some who are unable to sell and have even abandoned their homes because of concerns nearby turbines are affecting their health. (ONTARIO WIND POWER BRINGING DOWN PROPERTY VALUES, By John Nicol and Dave Seglins, SOURCE: CBC News, www.cbc.ca October 1, 2011) (http://betterplan.squarespace.com/todays-special/?currentPage=2)

The Drennans tried to talk to former homeowners who had lived close to turbines and who had been paid to move away by other energy companies to make room for more, only to be told by the one-time residents they were under a gag order as part of their respective buyouts.

They were forbidden from saying anything about wind turbines, health effects or otherwise. (FAMILY FIGHTS WIND POWER GAG ORDER, By Terry Davidson SOURCE Toronto Sun, www.torontosun.com September 13, 2011) (http://betterplan.squarespace.com/todays-special/?currentPage=3)

P343-05, cont.

Stepnell story: We had no choice but to leave our family home (http://www.windaction.org/stories/33199

What we didn't know then was the developer was not being truthful. We were not the 'last hold-out' at all. In later discussions with our neighbors we found out that in fact we were the very first farmers to sign up. I have since found out this kind of falsehood is a common tactic of wind developers. We had a peaceful community here before the developer showed up, but no more. Now it's neighbor against neighbor, family members not speaking to one another and there is no ease in conversation like in the old days. Everyone is afraid to talk for fear the subject of the wind turbines will come up. The kind of life we enjoyed in our community is gone forever. (http://betterplan.squarespace.com/wisconsin-farmer-regrets-sayin/)(**AN OPEN LETTER FROM A WISCONSIN FARMER WHO REGRETS SIGNING A WIND CONTRACT,** *"By signing that contract, I signed away the control of the family farm, and it's the biggest regret I have ever experienced and will ever experience." -Gary Steinich, Cambria, Wisconsin. June 2011)*

If these wind turbine get passed through for Pattern it will mean that Greed has been chosen over the People that live in the community of Ocotillo. Pattern has admitted that they will only make noise when they are working? Does this mean that they will never be working? They have also said that they know "That the wind doesn't always blow and that there will be many days that the turbines will not be working" So they obviously know that Ocotillo is not the location for these turbines. Like I said if you want them then please feel free to put them in your back yard or theirs and live with the noise that will be around 42 to 45 decimals which is equalvient to a dish washer running all the time?

P343-06

The thought of putting Wind Turbines ½ mile from residence is unacceptable, when we would prefer no Turbine. The thought of having these monstrous turbines in this residential is a night mare in itself. They do not belong anywhere near homes where people live. It has been proven that low frequency sound from wind turbines can make a house resign ate the sound like a speaker box, which causes health issues. Just image having the car next to you with his boom box and bass so loud that will your windows up you can still feel the vibration and hear the sound as if it was inside your car at any time of the day or night.

Patten promises jobs for this area. Have you taken note of how many jobs the residence of Ocotillo or Imperial Valley have since the Sunrise Power Link has begun. Very few and most of them that I have met are from San Diego County and the company Par is from Missouri. Next time you see them Par trucks check out their license plates MISSOURI is what I see. We already have many problems with this job and the many broken rules that they do not adhere to and the lack of support from the governing departments that are supposed to be protecting the land. Turned over port potties, speeding cement trucks with full loads along with fully loaded water trucks flying down residential roads well over the posted speed limits. The amount of dust flying from the disturbed roads when the wind pickup. If they ignore these complaints what or how are they going to be Pattern and it's disruption of the desert floor? What is going to happen to the residence of Ocotillo if they pollute our ground water which is our only source of water supply? Is the BLM and the county of Imperial going to be responsible for our future water at their cost?

P343-07

I am angry and feel betrayed I don't want these turbines in my community and if they go in it will feel as though we have been robbed of our future, just like it feels when someone breaks into your home and destroys your peace of mind. Life is never the same after that.

P.O. Box 444, Ocotillo, CA 92259
October 6, 2011

Cedric Perry, Project Manager
22835 Calle San Juan De Lagos
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951-697-5388
email: cperry@blm.vgov

Postmark deadline Oct. 6, 2011

Jeff Childers
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Angelina Havens
Imperial County Planning
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OCOTILLO EXPRESS WIND ENERGY FACILITY (OWEF) CACA 51552
Draft Plan Amendment & Draft Environmental Impact Statement/Draft Environmental Impact Report for BLM El Centro Field Office DOI Control No. DES 11-20, SCH No. 2010121055
Comments on Draft EIS/EIR (hard copy) of June 2011

"The Draft EIS/EIR will be circulated for a 90-day public comment period. **All comments must be postmarked no later than 10/6/11**, 90 days from the date the Notice of Availability for the Draft EIS/EIR published in the Federal Register by the Environmental Protection Agency. Comments may be sent to Cedric Perry, Project Manager, by mail: 22835 Calle San Juan De Los Lagos, Moreno Valley, CA, 92553; phone: (951) 697-5388; or email cperry@blm.gov ."

http://www.blm.gov/ca/st/en/fo/elcentro/nepa/ocotillo_express_wind.print.html

There simply was not enough time to complete review of the OWEF DEIS and compile comments so these comments are incomplete. Hopefully others will have covered issues I missed. **P344-01**

General comments

1. Ocotillo Express, LLC has applied to the BLM for a right-of-way (ROW) on public lands to construct a wind generation power plant facility just west of Ocotillo (30 miles west of El Centro). The project proposes to develop a 465 megawatt wind energy facility with 155 wind turbines on 12,436 acres (19.43 square miles) of mostly public lands administered by BLM surrounding the small residential community of Ocotillo to the on the north, west and south, as well 26 acres of private land under the jurisdiction of Imperial County to the west of the small unincorporated Ocotillo (DEIS ES-1, Vol II Fig 2.1-3) with fewer than 400 residents. The Maximum total height of the wind turbines ranges from 438 ft to 448 ft depending on manufacturer, with blades from 175.5 to 185.5 ft. (DEIS Vol II Fig 2.1-1). **P344-02**

2. The Executive Summary attempts to mislead the reviewers by stating that the 12,436 acres of BLM lands are "near the unincorporated community of Ocotillo" (ES-1), when in fact the BLM lands surround the community of Ocotillo on the north, west, and south as is seen in Vol II Fig. 2.1-2. **P344-03**

3. DEIS Vol II Appendix C Public Scoping Report dated March 2011 makes the proposed project location even more incorrect when it states that the applicant applied for a ROW on "public lands to construct a wind energy facility approximately five miles west of the community of Ocotillo". (DEIS Vol II Appendix C Sec. 1.1 at p1; Sec. 2.1.2.) Given the depiction in Vol II Fig. 1-1 Project location map and Fig. 2.1-1 "Electrical components of the proposed action" which actually show the location of homes in the community of Ocotillo with the project proposed to north, south and west of the existing community, the public deserves an answer as to why the Appendix C Scoping Report includes text which is grossly inconsistent with the figures in Vol II. **P344-04**

4. DEIS Vol II Appendix C Sec. 1.1 at p1; Sec. 2.1.2. at p.7 both state that the project is a 474 MW project on a 15,000-acre (23.4 square mile project site five miles west of Ocotillo. We know the location is incorrect with respect to Ocotillo, but what about the size and capacity of the proposed wind energy project? Is it what DEIS Vol I states, or what is stated in Volume II? See information in paragraph #1 above. **P344-05**

5. The BLM El Centro Field Office website info downloaded on 9/4/2011demonstrates the BLM's confusion about the size and proposed production of the proposed wind project. http://www.blm.gov/ca/st/en/fo/elcentro/nepa/ocotillo_express_wind.html (Exhibit 4) contains additional misinformation that is inconsistent with the text of the DEIS. It indicates that the project intends to produce 550 MW of electricity and the project site includes 15,000 acres of public lands. There is a significant difference between a 465 MW proposal identified in the DEIS and the 550 MW proposal identified on the BLM website for the project. How can the public be expected to place any confidence in the ability of the BLM to review and understand the project it purports to be reviewing if the agency can't even present consistent basic information about the size of the project??? **P344-06**

6. The BLM website has a date of 3/16/2011 and the DEIS Vol II Appendix C has a date of 3/4/2011, just 12 days earlier. **P344-07**

7. Why does the preparer of the DEIS refuse to correct obvious errors? What confidence can the public have in any of the material in the DEIS when the project location is incorrect as was repeatedly pointed out at public scoping meetings in both oral and written comments. Did BLM or Imperial County planning staff ever read the documents prior to public distribution? If they had, surely someone would have insisted on correcting such an error. **P344-08**

8. The requested ROW is for construction, operation, maintenance, and decommissioning the proposed utility scale wind energy project. Additionally, 487 acres of private and public land outside the project boundaries would be utilized for road access and collection line ROWs. (ES-1) **P344-09**

9. A 3.4 acre Operation and Maintenance facility including 4 permanent buildings will be enclosed by a permanent 7-foot high chain-link security fence surrounding the O&M facility. (DEIS at p. 2-5). The WTG steel-reinforced concrete foundation/pad , including permanent 60-ft by 100 ft crane pad and permanent 75 ft diameter area for the tower. (DEIS 2-4) This text implies privatization of public lands for private for-profit industrial purposes and suggests **P344-10**

that when and if the project is abandoned, that those permanent structures will remain, contrary to the use restrictions of the current Multiple Use Class L designation which restricts impacts from vehicle travel. **P344-010, cont.**

10. Undergrounding the electrical cables and trenching for 83 miles of fiber optic cables adjacent to access roads or "in some cases, running cross country" (DEIS 2-5) increases potential for erosion and maximizes adverse impacts to ground dwelling mammals, rodents, amphibians, insects and ground nesting birds. **P344-011**

11. Add to this a 4.2 acre substation, 31.7 acre utility switchyard,, a new 21 acre switchyard, underground collection system and more concrete for the permanent project substation and switchyard, 20 foot permanent access road (DEIS 2-6, 2-7), up to 42 miles of permanent access and maintenance roads, with roads up to 36 ft wide during construction, (DEIS 2-8) and industrialization of public lands looks not temporary but permanently private, carving up a sensitive resource area that is crossed by FEMA designated floodways. **P344-012**

12. Even more bizarre is the statement that there will be a 12 acre site for a concrete batch plant on public lands. The proposed size seems outrageous. This should not be permitted. Given the destructive and compacting nature of the activities proposed, it is most improbable that the site would be restored (DEIS 2-9) BLM has a dismal record, essentially total failure of restoration/reclamation in the Yuha Desert and areas where camping or and gravel operations occurred. In fact, BLM removed its signs for desert restoration because no one seemed to be able to explain why the dozing and trenching activities had been undertaken. In the past decades, revegetation has not been successful at "restoration" sites I have visited on BLM managed public lands in SW Imperial County. **P344-013**

13. Where, if anywhere in Imperial County, has there been a successful restoration or revegetation of a disturbed site on public lands managed by BLM? Every site of which I am aware has been a failed effort!! Big time failed effort on the western side of the county. Signs announcing BLM restoration projects have mostly been removed because the ECFO has been unable to explain what was done and why the effort failed. **P344-014**

14. From what direction are materials intended to be transported by rail? As far as I know, as of this week, it would not be possible for rail transit coming from the east because the tracks are not open. Nevertheless, a 10 acre railroad unloading area (DEIS 2-9) seems outrageously large to someone like me who lives in s subdivision where the lots are approximately 10 acres. **P344-015**

15. 50 acre-feet of water is proposed for dust suppression and turbine foundations, to come from a site other than the Ocotillo-Coyote Wells Sole Source aquifer.(DEIS 2-9) **P344-016**

16. BLM managed lands proposed for this industrial scale energy development have been designated Class L, Limited Use according to the California Desert Conservation Area Plan of 1980 as Amended. Class L restricts vehicular travel to approved routes of travel and as designated would prohibit such intensive industrial development and/or the creation of a network of new roads used to transport materials for construction. (See DEIS Vol II Fig. 2.1-2) **P344-017**

17. Applicant Pattern Energy has never completed a project of this magnitude anywhere according to statements made by the applicant at public meetings. Statements made by representatives of Pattern Energy at public meetings do NOT inspire any confidence or respect for the concerns of the residents and property owners of the Ocotillo area. **P344-018**

18. Indeed, the ES reveals that the Applicant still is uncertain of the generating capacity of the wind turbines, stating that the "range is from 1.6 to 3 MW in generating capacity" (ES-1). Why is it that the applicant is still uncertain about the generating capacity being proposed? **P344-019**

ES.2.1 BLM's Purpose and Need

19. The text fo the DEIS under Purpose and need is but an example of the failure of the BLM to realistically understand and plan for resource management on public lands within the California Desert Conservation Area that have been designated as Multiple Use Class L. Specifically, the ES.2 states: **P344-020**

> the purpose and need for the Proposed Action is to respond to a FLPMA ROW application submitted by the Applicant to construct, operate, maintain, and decommission a wind energy-generating facility and associated infrastructure on public lands administered by the BLM in compliance with FLPMA, BLM ROW regulations, and other applicable Federal laws and policies. (DEIS ES-2) (emphasis added)

20. The purpose and need is so narrowly defined as to make the intent of the applicant paramount and unreasonably constrains the alternatives discussed. (See also DEIS 2p-24 referring to Sec. 1.1) By limiting the alternatives discussion to projects or no projects the BLM failed to give adequate discussion to alternative locations, alternative technologies, or conservation/energy reduction efforts. BLM fails to consider whether there truly is a need to industrialize sensitive public lands located between two wilderness areas and adjacent to the Anza Borrego State Park at a site that is far from the remote coastal urban areas for which the generated electricity would be transmitted. **P344-021**

21. What BLM fails to state is that it could have responded to the application by informing the project applicant that the site proposed was inappropriate for such a project because of the need to protect and manage for other resource values. **P344-022**

22.

ES,2.4 Applicant's Objectives

23. After attending several public meetings, community meetings and scoping meetings, it seems quite obvious to me that the Applicant's real purpose is to make money, secure federal loans for an unaffordable and unneeded project on resource rich sensitive public lands. The staff for the applicant seem to have no concerns about public lands, their resources or the public. From statements Pattern staff have made at meetings it appears that Pattern believes if the company throws around enough promises of money hand outs, that they will get what they want. I sensed no sincerity in the statements of Pattern staff! They are getting paid to fly around, drive rental cars, probably stay at lodging more expensive than Motel 6, and eat at restaurants. They told the community that they were setting aside enough money to get their way and deal with lawsui9ts if necessary. **P344-023**

DEIS uses inconsistent identification for "Project Alternatives"

24. DEIS analyzes six alternatives which (according to the Executive Summary (DEIS at ES-1, and ES.3.1 Alternatives at ES-5,6, and 1-1) include **P344-024**

    * The Proposed Action - 155 Wind Turbine Generators (Alternative 1); (ES-1, ES-5)

* 137 Wind Turbine Generators Alternative (Alternative 2); (ES-1, ES-5)
* 105 Wind Turbine Generators Alternative (Alternative 3); (ES-1, ES-5)
* No issuance of a ROW grant or County approval/No Land Use Plan (LUP) Amendment (Alternative 4); (ES-1, ES-5)
* No issuance of a ROW grant or County approval/Approval of a land use plan amendment to exclude wind energy development on the site of the Proposed Action (Alternative 5); (ES-1, ES-5)
* No issuance of ROW grant or County approval/Approval of a land use plan amendment to make site available for future wind energy development (Alternative 6). (ES-1, ES-5)

P344-024, cont.

25. A similar description of the various Alternatives is included in the Dear Reader cover letter, and Sec. 2.1.2 list of Alternatives discussed in detail (DEIS 2-2), and included in Sec. 2.2 Proposed Land Use Amendment list of LUP amendment decisions at DEIS 2-21 with additional discussion in Sec. 2.5 No Project Alternatives, where Alternative 5 seems to be the recommended decision from the perspective of BLM management guidelines and public interest, even though it sounds as if the agency will choose to support what the Applicant wishes because of very distorted agency "Purpose and need".

P344-025

26. Please note that the County's preferred CEQA alternative is Alternative 3, with only 105 WTGs. This is in light of the fact that it supposedly cannot enthusiastically endorse any No Project Alternative. (DEIS 2-26)

P344-026

27. Text of the Abstract which precedes the Table of Contents and the Executive Summary identifies a very different set of numbering for the Alternatives. The Abstract identifies the Alternatives as:

    (1) No Action, in which the Applicant's application would be denied and current management of the site would be maintained; (DEIS Abstract)

    (2) No Project, in which the Applicant's application would be denied and the California Desert Conservation Area (CDCA (Plan would be amended to declare the site suitable for wind development; (DEIS Abstract)

    (3) No Project, in which the Applicant's application would be denied and the CDCA Plan would be amended to declare the site unsuitable for wind development; (DEIS Abstract)

    (4) the BLM would grant a ROW for the project as proposed with 155 wind turbines; (DEIS Abstract)

    (5) The BLM would grant the Applicant a ROW for a modified project design with 137 wind turbines;(DEIS Abstract)

    (6) The BLM would grant the applicant a ROW for a modified project design with 105 wind turbines. (DEIS Abstract)

P344-027

28. Giving the various Alternatives different Numbers in the Abstract and the Executive Summary appears to be an attempt to mislead the public. For example the Executive Summary identification of Alternative #3 seems to be the same as the Abstract's Alternative #6. It is an ominous sign when the first two pages of text following the cover letter identify the same

P344-028

"Alternative" with a different number. Either this is a failure of proof reading, sloppy inattention to detail, or an attempt to mislead the public into stating a preference for an Alternative which may not be what was understood at all. **P344-028, cont.**

BLM Agency Preferred Alternative ignores mandate of FLPMA and is inconsistent with Multiple Use Class L current restrictions on vehicle use

29. This reviewer was horrified to read that BLM has so little regard for the Class L- Limited use-resource values of the lands it has managed in the SW El Centro Field Office management area for the past 31 years that it would state that the "Agency Preferred Alternative" is the development of industrial scale wind energy project with all its roads, operations, maintenance operations on public lands where vehicle access has been restricted to protect resource values including biological and cultural resources on 12,436 acres of public lands. Such hipocracy! How can BLM expect anyone to respect its land use Classes when the agency itself endorses industrial privatization of public lands and the creation of many miles of new roads? Why, why, why? **P344-029**

30. Thus, the Public quickly sees that this DIES/R is off to a bad start when it comes to the intent to be a document for full disclosure of the environmental impacts of the proposed project and its various alternatives. **P344-030**

DEIS/EIR is user unfriendly and confusing without figures accompanying text in Vol I

31. The EIS/EIR is extremely user unfriendly and difficult to follow. Vol I contains no figures or tables to accompany the text as is customary so either the reviewer must ignore volume one and concentrate on the Technical appendices or continuously search back and forth between the two volumes, making review cumbersome at best. **P344-031**

DEIS/EIR is internally inconsistent when it refers to project location and DEIS vol II Appendix C Scoping Report fails to include any of the eight Appendices cited on p. 2-3.

32. See numbered comments 3, 4 in general comments above. **P344-032**

33. Additionally, the BLM Notice of Intent to prepare a DEIS includes the misinformation that the proposed project location is 5 miles west of Ocotillo. (Exhibit 1). See also the map from the BLM website which depicts the proposed project area surrounding Ocotillo on three sides. DEIS Vol II Appendix C Scoping Report asserts that the NOI is included in Appendix A-2, but the DEIS includes NO Appendix A-2. **P344-033**

34. DEIS vol II Appendix C Scoping Report additionally asserts that the County's CEQA NOP is included as Appendix A-1. But my hard copy contains no Appendix A-1. Nor is there any copy of an asserted public notice that supposedly went to the State Clearinghouse for the purposes of CEQA. My hard copy of DEIS Vol II contains no Appendix B-1. Nor is there any copy of an asserted BLM Press release supposedly included in a non-existent Appendix B-2. (See text at DEIS vol II Appendix C Scoping Report at p.1) **P344-034**

35. And the Appendix C Scoping report also fails to include Appendices C-1, C-2, C-3, C-4 or Appendix D identified at Appendix C p. 2-3 and 5. Why? This member of the public concludes that "fast-track" means sloppy inattention to details and failure of both County and BLM staff to review the DEIS/R prior to public distribution. **P344-035**

BLM Purpose Mischaracterizes intent of FLPMA Section 103 by omitting essential text

36. Text of the ES2.1 a d at 1-2 in BLM's Purpose mischaracterizes the intent of FLPMA Section 103 by limiting the text to only one very small portion of Section 103 when it says:"takes into account the long term needs of future generations for renewable and non-renewable resources." (ES-2; 1-2, and 1-8). **P344-036**

37. By contrast, the California Desert Conservation Area (CDCA) Plan 1980 As Amended in August1999 makes the following statement about the importance of FLPMA Section 601 and FLPMA Section 103, quoting from the CDCA Plan Introduction at p. 5:

> "Section 601 of FLPMA requires that BLM develop a plan to "...provide for the immediate and future protection and administration of the public lands in the California Desert within the framework of a program of multiple use and sustained yield, and the maintenance of environmental quality." Section 103 of FLPMA defines the terms "multiple use" and "sustained yield" as follows:
>
> > "The term "multiple use" means the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making that most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timer, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output. (Emphasis added.) (CDCA Plan p. 5)
> >
> > ***
> >
> > "The term "sustained yield" means the achievement and maintenance in perpetuity of high-level annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use. "(CDCA Plan p. 5)

P344-037

38. None of the DEIS ES.2; 1-2 cited Executive Orders includes text that suggests that the intent of FLPMA shall be so narrowly interpreted as to omit the text following the words nonrenewable resources . Indeed, the Secretarial Order 3285A1 (ES-2; 1-3) does not state that development of renewable energy is a priority which trumps all other resource values of public lands, especially public lands that without a CDCA Plan Amendment are still designated ad Multiple Use Class L. **P344-038**

39. CDCA Plan 1980 as Amended 1999 the Multiple Use Class L as follows:

> MULTIPLE-USE CLASS L
>
> "Multiple-Use Class L (Limited Use) protects sensitive, natural, scenic, ecological, and cultural resource values. Public lands designated as Class L are managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values are not significantly diminished." (CDCA Plan p. 13) (DEIS 1-8)

P344-039

40. The CDCA Plan's discussion of Management Principles includes the following text:

> —Responding to national priority needs for resource use and development, both today and in the future, including such paramount priorities as energy development and transmission, without compromising the basic desert resources of soil, air, water, and vegetation, or public

P344-040

> values such as wildlife, cultural resources, or magnificent desert scenery. This means, in the face of unknowns, erring on the side of conservation in order not to risk today what we cannot replace tomorrow. (CDCA Plan p.6)

P344-040, cont.

41. The CDCA Plan Introduction concludes with this statement of the Intent of the Plan :

> INTENT OF THE PLAN
>
> Based upon these principles and concepts, the intent of the CDCA Plan is to ensure as nearly as humanly possible that the recognition brought by Congress and the people into law—that the California Desert is not a wasteland but a precious public resource — is effectively guaranteed in its management, that the uses of today do not preclude the users of tomorrow, and that we preserve and develop these assets wisely with full regard for their social and environmental as well as economic values. (CDCA Plan at p.7) (emphasis added)

P344-041

42. From the above CDCA text, it would appear that the proposed industrial scale wind energy project at the site(s) proposed is absolutely inconsistent with the resource values which for the past 31 years left BLM and the public believing that Class L lands where to be managed with vehicular use was limited to approved routes of travel in order to protect the important cultural, ecological and biological resources of the area between the Coyote Mts Wilderness to the north, the Jacumba Wilderness Area to the South and the Anza Borrego State Park to the West. Given the already identified sensitive resource values that BLM should/must err on the side of conservation in order not to risk today what cannot be replaced tomorrow and run the risk of starting the conversion of a resource rich area into a wasteland for a private for-profit industrial scale wind energy project.

P344-042

43. For BLM to decide to deny the proposed wind energy project seems entirely consistent with the intent of Congress when it enacted the Federal Land Management Policy Act. The text of 43 CFR 1701 (8) follows:

> (8) the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use; (43 CFR 1701)

P344-043

44. DEIS Appendix B Sec. B.4.D referring to FLPMA stresses the importance of "encouraging collaboration and public participation throughout the planning process." (DEIS V. II at B-5, emphasis added.)

P344-044

DEIS Vol II Appendix C "Public Scoping Report" excludes text of scoping comments and fails to list all submitting substantive written and oral scoping comments

45. However, contrary to the practice in preparation of other DEIS/EIRs for projects in Imperial County, this DEIS Vol II Appendix C Public Scoping Report (Sec. 1.3 at p. 3-4) EXCLUDES ALL of the oral comments and ALL of the written scoping comments from both individuals, organizations, and agencies. (DEIS vol II Appendix C Public Scoping Report dated March 4, 2011 is 23 pages long both in the hard copy of the DEIS and on the CD provided by County of Imperial and on the County's Planning website 59appC Public scoping report at : ftp://ftp.co.imperial.ca.us/icpds/eir/ocotillo-express/59appc-public-scoping-report.pdf. Which is referenced at a BLM website.)

P344-045

46. Furthermore, even though Appendix C Table 1 includes a list of those submitting comments

P344-046

during the Scoping period, the Appendix C fails to include both detailed written and oral comments from Mike Cuff and health related concerns of Dr. Fred Cagle or anyone else. WHY? **P344-046, cont.**

47. Was it because the list of concerns submitted by Mike Cuff was not something the preparer of the DEIS wanted the public to see. Mr. Cuff has shared the scoping letter he timely submitted to BLM and the concerns are detailed and substantive. The general public has a right to see what Mr. Cuff and others shared with BLM. **P344-047**

48. DEIS Vol II Appendix C Public Scoping Report (Sec. 1.3 at p. 3, and 5) incorrectly asserts that Summary transcripts of verbal public comments from the public scoping meetings are included as Appendices E and F. No such appendices are included in my copy of DEIS Vol II following Appendix C. **P344-048**

49. Similarly DEIS Vol II Appendix C Public Scoping Report (Sec. 1.3 at p. 3 hard copy and County website) incorrectly asserts that "Written comments received during the public scoping meetings and in response to the NOP/NOI are included in Appendix G." Once again, there is no Appendix G with the public scoping comments even though such an Appendix G is again identified at p. 5.. Sloppy inattention to document preparation or an intent to withhold important information? **P344-049**

50. Failing to include comments so that the public can learn of the concerns of those who submitted substantive comments and concerns has the effect of denying public participation in the process. Failure to include Scoping concerns deprives the public and agencies the opportunity to determine whether or not the scoping concerns have actually been addressed or merely ignored. **P344-050**

51. Because the DEIS failed to include scoping comments or scoping letters or even identify all who submitted such comments, the public has no way of knowing whether or not the DEIS identified the key issues of concern to the public. **P344-051**

BLM El Centro website includes additional misinformation and contains information not found in the hard copies of the DEIS/R or the County website for DEIS Vol II Appendix C.

52. The BLM El Centro Field Office website (Exhibit 4): http://www.blm.gov/ca/st/en/fo/elcentro/nepa/ocotillo_express_wind.html contains additional misinformation that is inconsistent with the text of the DEIS. It indicates that the project intends to produce 550 MW of electricity and the project site includes 15,000 acres of public lands. I had not seen this website until it was forwarded to me by Donna Tisdale after I called to ask if her hard copy was also missing all twelve appendices for the Vol II Appendix C Public Scoping Report. The BLM website includes the Appendix C Public Scoping Report with a date of 3/16/2011, or less than 2 weeks after to the hard copy and County Appendix C dated March 4, 2011 which has been reduced down to 23 pages and excludes all appendices. **P344-052**

53. Why has the preparer of the DEIS/R chosen to remove all appendices from the Vol. II in hard copy and County website? **P344-053**

54. I did not find any place among the myriad of relevant and irrelevant Federal Laws, Regulations and Executive Orders any text directing that any project subject to NEPA review exclude the Scoping comments or exclude even identifying those who submitted substantive written and/or oral scoping comments. **P344-054**

55. Identification of what appear to be irrelevant regulations include those related to the Colorado River (DEIS Vol II, Appendix B at p. B-18). Why? Because the Colorado River is about 80 miles to the east of the proposed wind project site. Inclusion of Colorado River information suggests that the preparer of the DEIS is doing a cut and paste job of extracting materials from other NEPA/CEQA documents and adding then either to confuse reviewers or add unnecessary pages. Probably some information was added in response to EPA's concerns about downgradient impacts to waters of the US that would inevitably result form construction and roads crossing the FEMA designated floodways to the west and southwest of Ocotillo. **P344-055**

Project should be denied if BLM expects public to respect Multiple Use Class Designations of CDCA Plan

56. In spite of text of ES.3 Decisions, BLM cannot and should not ignore the text of the introduction to the CDCA Plan and the past Multiple Use Class designations if it expects public adherence to vehicle route restrictions. **P344-056**

Project not viable without input of Federal monies

57. ES.2.2 and 1.1.3 Dept of Energy (DOE) Purpose reveals that the Applicant require a DOE loan guarantee for project. (ES-2) **P344-057**

58. We note that there would be no power provided for use in Imperial County and question whether the federal monies might not be better spent to improve insulation, energy efficiency and landscaping to reduce energy use by housing in Imperial County where I was told there are about 7,700 mobile homes or motorhomes used as residences. Spending federal revenues to improve housing stock and reduce electrical consumption, especially in the hot summer months, in Imperial County would both improve the quality of life and provide employment for local Imperial County residents. The project as proposed is to export power to more affluent communities served by San Diego Gas and Electric along the coast of California. **P344-058**

59. ES.2.4 Applicant"s Objectives is misleading because it asserts a purpose of using "California's existing transmission grid" (ES-3). This is not true. From what Applicant has stated, it sounds as if the Applicant intends to send power over the not yet constructed Sunrise Powerlink, (ES-4) a controversial construction project where local residents are already being adversely by truck traffic and lighting that has stadium like impacts felt even miles away. Apparently the only way this could be considered "cost competitive" (ES-3) is if the American taxpayers subsidize the project with "a loan guarantee" (ES-2) **P344-059**

ES.5.3 Areas of Controversy (ES-16) ignores public concerns about public health and safety raised during scoping

60. There was much public comment, both written and oral raising concerns about the public health impacts of noise and low frequence and infra sound on humans and animals, and about potential for increased asthma, allergies and increased incidence of valley fever from disturbing soils in a valley fever endemic area. Dr. Fred Cagle raised concerns about valley fever during Scoping as did I. Dr. Cagle's name is not even included among those commenting at scooping meetings In DEIS Vol II Appendix C. Why? **P344-060**

61. Why were public health issues including allergies, asthma, and infectious diseases not included among the areas of Controversy? To ignore these issues is to ignore public scoping concerns. **P344-061**

General Location and Map is missing from Vol. I

62. DEIS Sec. 1.2 (at DEIS 1-5 and 1-6) refer to Figure 1-1 and Fig 2.3-1 and Fig. 3.16-1, but the Figures are not found in this section., nor is there any indication in the text of where such Figures and project component locations might be found. Graphic depiction of identified figures should be included under the heading "General Location and Map". To fail to do so is to leave the concerned public who are not local residents wondering where the location is. This is the first CEQA/NEPA document I have ever reviewed that failed to include any kind of figure to depict the project location and go with the text. These figures are essential to reveal that the proposed project surrounds the unincorporated community of Ocotillo on the north, west, and south. Indeed, DEIS 3.2-2 in discussing air quality states that: "The OWEF is located north, south, and west of the unincorporated community of Ocotillo, in Imperial County." So why does the DEIS present inconsistent information about the true location of the proposed OWEF in relation to the community of Ocotillo?

P344-062

What are the total Greenhouse gas Emissions related to transport and use of the heavy equipment needed for site preparation and gravel, aggregate, and concrete needs?

63. DEIS in Secs. 2.1.3.2.2 to 2.1.3.2.5 identifies a lot of heavy machinery and equipment needed for site preparation and then includes Table 2-2 that shows quantities and locations of source materials for concrete construction, However, there is no table that reveals how much GHG would be emitted during the transportation related aspects of those materials identified at DEIS vol I p. 2-12 to 2-13 even though both the ES-3 and DEIS 1-4 under "Applicant's Objectives" identified "greenhouse gas (GHG) emissions reduction". The local and general public need to know the true nature of the impacts, and obviously given the transportation requirements it appe4ars that there would be substantial quantities of GHG emissions in these construction related activities.

P344-063

DEIS Sec. 2.3.1 Many, many permanent components of project make nothing sound temporary or easily removed or reclaimed

64. The list of components or aspects of project that sound "permanent" in Sec. 2.3.1 include:

* WTG foundation/pad with "permanent 60-foot by 100 foot crane pad and a permanent 75-foot diameter area ...for the tower" (DEIS 2-4)
* Operation & maintenance facility with "four permanent buildings" (DEIS 2-5)
* "Permanent 7 foot high security fence surrounding O&M facility" buildings (DEIS 2-5)
* 83 miles of underground fiber optic cables (DEIS 2-5)
* "20-foot permanent access road" (DEIS 2-7)

P344-064

Damage to public lands caused by construction, compaction and vibration of 42 miles of roads originally 36 feet in width during construction, and thereafter 20 feet wide, not easily restored or reclaimed

65. Discussion of roads, temporary work area of 400 diameter, (DEIS 2-8)concrete batch plant/Laydown area of 12 acres (DEIS 2-9) are unlikely to be restored or reclaimed due to heavy impacts because BLM cannot direct public to sites where such effects have been successfully remediated in Imperial County..

P344-065

Construction hours of operation as proposed will be disruptive of existing community sleep patterns, disregards the surrounded community of Ocotillo and is an Environmental Justice issue for this economically challenged community.

66. DEIS Sec. 2.1.3.2 Construction states that:

> Construction would typically occur during daylight hours (6- to 10-hour days) from Monday through Saturday. However, to meet schedule demands, it may be necessary to work early morning, evenings, or even nights and/or Sundays during certain phases of construction (e.g. during the foundation concrete hours to take advantage of the cooler times of the day, and during the turbine erection period to take advantage of the times the wind speed is below the maximum safe working conditions, etc.) (DEIS 2-11) (emphasis added)

P344-066

67. Later this section states that a plan for employee transportation "would be completed prior to construction" (DEIS 2-11) (but has not been done for public review) and that it "may include" a plan for employee carpooling (DEIS 2-11). But, of course, it also may not include any recommendation or requirement for car-pooling. Such plans should not be deferred to some future time.

P344-067

68. DEIS vol 2 gives another reason for construction during hours which will be disturbing to local residents when Appendix D Biological Technical Report at p. 2 states that:

69. In general, employees would work six 10-hour days (Monday through Saturday) during daylight hours. However, to meet the schedule, it may be necessary to work early morning, evenings, or nights, and/or Sundays during the foundation concrete pours to take advantage of the potential biological construction constraints for PBS and the cooler times of the day, and during the WTG erection period to take advantage of times when the wind speed is below the maximum safe working conditions. (Emphasis added) (DEIS Vol 2 App. D at p2.)

P344-068

70. This information provides no citation for the Bighorn sheep constraints, nor does it identify what those "biological constraints" (DEIS vol 2 App D p.2) might be.. Why? Do human receptors and their sleep needs count also?

P344-069

71. Sound travels a long distance in the quiet of the desert as residents and Border Patrol agents can readily attest.

P344-070

72. Therefore early morning or night times will adversely impact the sleep patterns of desert residents. If the project is approved, there is a simple way to find "cooler times of the day" rather than night time operations. Winter months have much cooler ambient temperatures that accompany the shorter day length. Such construction times would be respectful of the community, rather than simply for the convenience of the applicant!

P344-071

73. There are numerous published studies and reports of impacts of noise associated with wind turbine projects on sleep. Exhibit 5 is the "Adverse health effects-Summary of new evidence August 2011" and Exhibit 6 is a PowerPoint presentation called "Adverse effects of wind development in Australia, June 2011". Certainly the increased noise and traffic associated with construction would be even a greater adverse impact.

P344-072

74. There is abundant information in the medical literature that related to adverse health impacts of noise and sleep deprivation, including a 425 page report available from the titled:

Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem Harvey R. Colten and Bruce M. Altevogt, Editors, Committee on Sleep Medicine and Research, Institute of Medicine, National Academies Press. (This PDF is available from the National Academies Press at: http://www.nap.edu/catalog/11617.html)

P344-073

75. From the perspective of the public and of one who has many friends living in the Ocotillo/Nomirage area that will be adversely impacted by the noises of nighttime operations for construction, I am convinced that this is an environmental justice issue. The Ocotillo area is one with low incomes and residents are not likely to be able to afford to move somewhere else to avoid the noises of construction temporarily or away form the noise of the wind turbines permanently if their health and sleep is adversely impacted. Therefore, nighttime construction operations should not be permitted if the project is approved..

P344-074

Sec. 2.1.3.2.3 Site Preparation, Vegetation Removal & treatment and following construction sections

76. This section makes no sense to long term desert residents. "Mowing and trimming vegetation" and areas cleared of vegetation, trenching and using large scale excavators, road construction and trenching for underground cables (DEIS 2-12, 2-13, 2-14) sound more like killing the vegetation even if subsurface roots are not outright destroyed.

P344-075

77. All of these activities sound in sharp contrast to any notion of "preserving desert crust", preserving topsoil, etc (DEIS 2-15) and make it seem unlikely that there will eve be any meaningful site restoration even remotely resembling the present desert during the lifetimes of residents of Ocotillo. Please have BLM El Centro Field Office identify any sites in SW Imperial County where it feels there has been successful restoration after heavy usage. All sites that I recall seeing with BLM Desert Restoration signs were a dismal failure and eventually most, but not all, signs have been removed, presumably not to embarrass the agency which could never provide additional information about techniques and why such techniques had been used. The only successes of which I am aware have been done by Student Conservation Association work crews attempting to visually disguise illegal cross-country vehicle travel.

P344-076

Sec. 2.1.3.4 Decommissioning plan has been deferred and not available for public review

78. PPA & ROW "agreement have expirations of 20 and 30 years, respectively." (DEIS 2.1.3.4 Decommissioning at p. 2-15.) Decommissioning detailed at DEIS 2-16. But the text states that: "Prior to the termination of the ROW authorization, a decommissioning plan would be developed consistent with the BLM Wind Energy Program EIS/ROD, and approved by the BLM." (DEIS 2-16) Even the project applicant told the residents of the local community that the project might not last even 20 years.

P344-077

79. Why then has no detailed decommissioning plan been made public? What information is included in the list makes it seem as if there will be a tremendous amount of disturbance and subsurface concrete and buried cables left in place, aspects in addition to heavily compacted roads that will permanently alter the physical nature of the desert soils and vegetation of the area, and most likely alter the drainage patterns in an area crossed by FEMA designated floodways as seen in DEIS Vol II Fig. 3.20-2 "FEMA designated flood hazard areas". Without any details, references to "current adjacent land use" (DEIS 2-16) in this BLM Multiple Use Class L or Limited, seem empty and without any meaning. That is probably why all figures and photos are included in DEIS Vol. II rather than near relevant text in Vol.1.

P344-078

Sec. 2.1.3.5 Design features and Best Management Practices includes a list of plans deferred to future and not available for public review with DEIS

80. "An ABPP and ECP will be completed ..." (DEIS 2-17); "A spill prevention containment and countermeasure (SPCC) plan will be implemented" (DEIS 2-17). **P344-079**

81. "A full list of BMPs will be developed and all construction and operations plans will be reviewed and approved by BLM prior to implementation." (DEIS 2-18) **P344-080**

82. "A **Transportation Plan** shall be developed, prior to the transport of turbine components, main assembly cranes, and other large pieces of equipment." (DEIS 2-18) **P344-081**

83. "A **Traffic Management Plan** shall be prepared prior to construction as part of the Transportation Plan .." (DEIS 2-18) **P344-082**

84. (A Storm Water Pollution Prevention Plan (SWPPP) will be developed" (DEIS 2-18) **P344-083**

85. "A **Construction Waste Management Plan** will be developed to define the minimum practices..." (DEIS 2-19) **P344-084**

86. A **Dust Abatement Plan** for construction and operations will be developed prior to construction..." (DEIS 2-18) .... The following DEIS text relies on incorrect or inapplicable climatic assumptions:

> "Important components of the project dust abatement plan include use of magnesium chloride (MgCl) (flake or liquid solution) for dust control on roads during construction and use of signage to restrict off-highway vehicles from using newly constructed wind farm roads during and after construction in coordination with the BLM. (DEIS 2-18)
>
> "MgCl as a dust palliative works by absorbing water from the air and binding road materials together to create a relatively hard road surface. As a dust control mechanism on construction roads, MgCl occurs naturally as evaporated brine (U.S. Department of Agriculture, Dust Palliative Selection and Application Guide), is well suited for the project site, and offers several significant advantages. MgCl is effective in hot and dry climates because it starts to absorb water from the air at low relative humidity (32%) and its ability to absorb water is independent of temperature. Relative humidity data from El Centro indicates that, on average, the relative humidity at night time regularly exceeds 32 percent even during the driest months of June. During the wettest month of January, the relative humidity, on average, exceeds 32 percent during all but 4 of the hottest hours of the day. Environmental impacts of MgCl are extremely low in desert type environments where fresh surface water is scarce and the vegetation is specialized to the highly alkaline soils (pH > 8). The primary advantage of using MgCl as a dust suppression palliative for the OWEF is the estimated amount of water needed for dust suppression is reduced by approximately 75 percent. This water-use reduction directly relates to reducing the number of water truck trips for dust control. Under the correct application procedures, MgCl only needs to be applied once or twice per construction season." (Emphasis added) (DEIS 2-18)

P344-085

87. The text of the above section is misleading because it relies on information from El Centro which is located in the center of a heavily irrigated area and has a relative humidity much higher than the open desert 30 miles to the west and a lower ambient temperature because of evaporative cooling. If data had been used from the Ocotillo area where I live, one would have known that the ambient temperatures are about 10 degrees F higher in the open desert in both winter and summer than those reported for El Centro and the relative humidity is only a fraction of what it is in the irrigated portion of the Imperial Valley. The eastern most part of **P344-086**

the project site is 24 milers due west of El Centro (DEIS Vol II Fig. 4.1-1b Cumulative Projects) and about 15 miles due west of the western portion of irrigated agriculture. The western boundary of the proposed OWEF site is ab9ut 32 miles due west fo El Centro. I am confident that most if not all residents of Imperial County are well aware that temperature and humidity changes dramatically once one leaves the desert and travels though irrigated areas where there is evaporative cooling.

88. So will using MgCl as a dust suppressant/binder work where ambient temperatures are higher and relative humidity lower than assumed?

Other Plans deferred to future include resource conservation measures

89. Th following text related to applicant intent includes too many qualifiers to sound convincing.

> The Applicant also intends to develop a **Cultural Resource Monitoring and Mitigation Plan** prior to the start of construction that will include a procedure for identifying areas to be monitored during construction and that will ensure qualified archaeological monitors are used to carry out this task. A discovery plan, which may be part of the cultural resource monitoring and mitigation plan, may be part of the proposed mitigation ." (DEIS 2-19)

90. ".**Restoration Plan**. A plan would be prepared prior to restoration activities occurring onsite" (DEIS 2-19)

91. Also intent to develop a Noxious weed control program, an integrated pest management program to be developed (DEIS 2-20)

92. Failure to disclose the details of the many identified future possible plans is unacceptable unless BLM has an intent to approve only Alternative 5 which is to not grant the ROW and amend the CDCA Plan to exclude future wind energy project development at the proposed OWEF site.

Sec. 2.8 Alternatives but eliminated from detailed analysis

93. Why did the DEIS fail to consider an alternative wind energy technology that is more efficient and requires less land? Please see the following article on vertical axis wind turbines: (Exhibit 7) "Bold new approach to wind 'farm' design may provide efficiency gains" (http://www.sciencedaily.com/releases/2011/07/110713131644.htm) This technology should be evaluated and considered as a means of accomplishing the set energy goals but with a different technology and far fewer environmental impacts.

94. Sec. 2.8.6 Other types of energy projects that were dismissed reveals that the entire analysis is driven by BLM's narrowly defined purpose for NEPA review stated as follows: "Generally, these alternatives were not carried for NEPA purposes by the BLM because they do not

should have not considered for project review. It is my understanding that the Section 106 Consultation with the tribes was never completed as required prior to project approval and that was why the Preliminary Injunction was granted in the litigation filed by the Quechan Tribe. Given the vocal objections of many Native American Tribes relative to the OWEF project, BLM most certainly should have considered a less land intensive alternative such as vertical axis wind generation.

P344-094, cont.

3.2 & 4.2 Air Resources

96. It is inappropriate to use temperature and relative humidity data from El Centro, an urban area that is more than 24 miles due east of the easternmost project boundary and surrounded by flood irrigated agricultural lands with a lot of evaporation and evapotranspiration. (DEIS Vol II Fig. 4.1-1b Cumulative Projects depicts location of El Centro in relation to the OWEF to the west.). The OWEF eastern boundary is about 15 miles due west of the western portion of irrigated agriculture. This makes for a very different temperature and humidity scenario throughout the year.

P344-095

97. Why does the air section meteorological conditions provide data from El Centro rather than from Ocotillo? (DEIS 3.2-1)

P344-096

98. Why does this section refer to the wind directions relying on information from Boulevard in the mountains ten miles to the west? (DEIS 3.2-1).

P344-097

99. It is. However, of interest to note that in discussion of air resources the DEIS for the first time honestly reveals that the proposed OWEF is located to the north, south and west of the unincorporated community of Ocotillo! (DEIS 3.2-2)

P344-098

100. It is likely that disturbing the acreage of undisturbed desert for the proposed OWEF, together with construction and transportation activities, will increase the number of days exceeding NAAQS and CAAQS for PM 10 and for federal PM 2.5 not only in El Centro at the monitoring station, but also for the residents of Ocotillo. (See Table 3.2-4)

P344-099

Ocotillo is a community with a high percentage of "sensitive receptors"

101. "Sensitive population groups include children, the elderly, the acutely ill and the chronically ill, especially those with cardio-respiratory diseases. (DEIS 3.2-5)

"Residential areas are also considered to be sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present. Recreational land uses are considered moderately sensitive to air pollution. Although exposure periods are generally short, exercise places a high demand on respiratory functions, which can be impaired by air pollution. In addition, noticeable air pollution can detract from the enjoyment of recreation. "(DEIS 3.2-5)

P344-100

102. .By asserting that there are no sensitive receptors because there are no schools or hospitals located near the project site (DEIS 3.2-5) is an insult to the many elderly and disabled and children who live in the community of Ocotillo which is downwind from and surrounded on three sides by the project. The final paragraph is Section 3.2.1.4 Sensitive Receptors is inconsistent with the definition of sensitive receptors in the first paragraph. Why???

P344-101

103. Sec. 4.2.9.1 states that the "geographic scope for air quality cumulative impacts is a six mile radius for regionally baaed impacts and a one-mile radius for sensitive receptors." (DEIS 4.2-

P344-102

15) **P344-102, cont.**

104. Tables 4.2-3 and 4.2-4 Maximum mitigated daily and annual construction emissions in lbs/day and tons/year (DEIS 4,2-3) fail to disclose the site where these emissions would be expected. Why? Are these the expected emissions to which Ocotillo residents will be exposed or is it the emissions anticipated at an El Centro monitoring station more than 24 miles ot the east? When the monitoring site is not disclosed, it provides no baseline for the potential adverse impacts to human health. Because the construction is anticipated to continue for 2 years, the local health impacts in Ocotillo would be far more serious than impacts in El Centro, some 24 miles to the east. **P344-103**

105. OWEF construction would incre3ase emissions and particulates in the Ocotillo area where activities are occurring during the period of construction, and decommissioning. Ocotillo is an unincorporated community with a high percentage of sensitive receptors, so the impacts would likely be considered significant locally. Indeed, many residents are already complaining about the increased blowing dust and sand that have been stirred up" by the lay-down and construction activities associated with the ongoing construction of the towers for the Sunrise Powerlink with a transmission corridor which overlaps the proposed OWEF. **P344-104**

106. Under Decommissioning, the following statement is largely untrue with respect to residential and school development.

> **AR-4.** Coyote Wells Specific Plan project, which includes new residential and school development, is proposed within a mile of the proposed OWEF (described in Section 4.2.9). Therefore, it is likely that there would be additional residential receptors, and potentially new sensitive receptors, located within a mile of the project site at the time of project decommissioning. Any receptors located near to the proposed OWEF site would have increased air pollutant exposures from project decommissioning; (DEIS 4.2-8)

P344-105

107. .If I recall correctly, the CWSP was estimated to have the potential for nine new residents and I recall no mention of any school for the Ocotillo area. The CWSP is intended as a gated military/law enforcement training facility and luxury motorsports facility with a private heliport and landing strip. See Exhibits 8 and 10, 11A-11D for details about the CWSP. Exhibits 11A through 11D and screen captures from the Wind Zero website in February 2010 and clearly attest to the fact that the project was intended as a training facility not a residential community. **P344-106**

108. It is most unlikely that a community with a population of fewer than 400 persons in the SW corner of Imperial County would be a likely location for a new school because if not withdrawn the CWSP together with OWEF are likely to make the communities of Ocotillo and Nomirage undesirable places to live and the population is likely to decrease rather than increase based on conversations with residents of the communities during the past year. **P344-107**

109. At no time during the public review process for the CWSP was the proposed Wind Zero Training Facility ever referred to as a "school". **P344-108**

3.3 4.3 Climate Change, ... Dust generation, and carbon sequestration

110. The concerns about dust generation and carbon sequestration discussed below are related to air quality, climate change and public health sections of the DEIS. **P344-109**

111. It seems obvious from the discussion in Section 4.3 that GHG construction and operations vehicle emissions will increase in the project vicinity area. Thus, although the text asserts that there will be an ultimate GHG and emissions reduction somewhere else, the situation in the desert will be adversely impacted with no potential reduction. **P344-110**

112. DEIS sec. 4.3.3.1 acknowledges aan increase in local generation of GHG related to construction and transportation of both people and materials and water for construction activities (DEIS 4.3-1). Without providing any evidence or citing any references, the DEIS then goes on to suggest that there is only a small increase in GHG emissions due to loss of carbon uptake from vegetation. **P344-111**

113. However, the published scientific literature and information learned from attending recent meetings on climate change in the deserts suggests that the deserts represent a significant place of carbon sequestration, and that direct impacts to disturbing vegetation and soils will create significant losses and increased dust deposition on vegetation will reduce photosynthetic activity at a location such as the proposed project site which receives only occasional rainfall which may or may not be enough to rinse dust from vegetative surfaces. See Exhibit 20: Field at al. 2009. "The Ecology of Dust." In Frontiers in Ecology and the Environment at *Front Ecol Environ* 2009; doi:10.1890/090050 at www.frontiersinecology.org. **P344-112**

114. This important summary serves to:

115. "provide a general overview of the ecological importance of dust, examine complex interactions between wind erosion and ecosystem dynamics from the scale of plants and surrounding space to regional and global scales, and highlight specific examples of how disturbance affects these interactions and their consequences. It is likely that changes in climate and intensification of land use will lead to increased dust production from many drylands. To address these issues, environmental scientists, land managers, and policy makers need to consider wind erosion and dust emission more explicitly in resource management decisions. " (emphasis added)(from the Abstract for "The Ecology of dust") (Exhibit 26) **P344-113**

116. Most certainly the creation of new heavily used and very wide dirt roads for the construction of the proposed wind turbine project would result in additional dust generation, which will inevitably adversely impact the carbon sequestration in desert soils. How this works is explained by the following test from Allen re impacts of large scale solar projects/land surface disturbing projects in the desert. Impacts from the OWEF would impact the environment i9n similar ways though with less direct surface disturbance. Desert plants sequester carbon into the root zone where it carbon dioxide is released back into the soil where some carbon interacts with calcium to form calcium carbonate. Soil carbon dioxide binds with soil calcium to form caliche. **P344-114**

117. "Our deserts have large amounts of CO2 stored as caliche (CaCO3). The amount of C in caliche, when accounted globally, may be equal to the entire C as CO2 in the atmosphere. This caliche is formed from weathering of Ca in desert soils binding to carbonates that originate in large part from roots and soil organisms. Most of the caliche in the deserts was formed during the ice ages when vegetation was more dense and more productive. These deposits have likely been stable since. (Schlesinger 1984). Being stable, though, means that inputs equal exports. Carbon in caliche may in fact **P344-115**

be released, especially when vegetation and soils are disturbed.." (Allen 2011-Gaps in Desert Research) (Exhibit 25)

P344-115, cont.

118. The concerns related to dust generation and transport and carbon sequestration are applicable to all but the No Project alternatives. In its discussion of "Operation and Maintenance" (DEIS 4.3-2, 4.3-3) the text talks about reduction in carbon uptake by desert vegetation associated with vegetation removal, but fails to consider the implications in the Allen paper that most of the carbon sequestered in desert soils occurred when caliche was formed during the ice ages when desert vegetation was more abundant and more productive and that disturbing desert soils may release significant amounts of stored carbon. Failure to consider losses of carbon that has been sequestered in caliche of the desert soils of the proposed project site for the thousands of years since the caliche was formed during the ice age thousands of years ago renders the DEIS discussion of carbon and CO2 balance in the proposed project area woefully inadequate and incomplete.

P344-116

119. Removal of vegetation, road building and road compaction will all have impacts on the carbon/CO2 balance of the project area because they will all impact the caliche which is so abundant fairly near the surface in the proposed project area, caliche that has "survived" with its carbon sequestered for thousands of years. For a 20 to 30 year project, impacts to this ancient caliche would release a substantial quantity of carbon far greater than might be suggested as loss of uptake of carbon associated with complete vegetation removal (DEIS 4.3-3 citing Wolfhfahrt et al 2008).

P344-117

120. Reviewing the abstract of the Wohlfahrt et al article in Global Change Biology, Wohlfahrt's abstract includes the following statement: "Our results indicate that desert ecosystem CO_2 exchange may be playing a much larger role in global carbon cycling and in modulating atmospheric CO_2 levels than previously assumed – especially since arid and semiarid biomes make up >30% of Earth's land surface." (Wohlfahrt. G. Et al 2008 from abstract.)

P344-118

121. Without considering the loss of carbon stored in caliche as suggested by the Allen paper, the Wohlfahrt estimation of loss of carbon uptake by removal of vegetation would appear to be an inaccurate portrayal of the importance and figures for loss of carbon in the proposed project area because the DEIS includes only one aspect of the desert carbon sequestration picture without discussing what happens to the below ground storage of carbon in caliche as the land uses/impacts at the ground surface/subsurface would be changed if the proposed project is constructed with all the associated road construction, vegetation clearing and foundations for tower installation and associated structures. Discussions of GHG emissions are incomplete

P344-119

122. Because there are serious unaddressed or inadequately addressed carbon storage issues, the most appropriate decision for BLM is the Alternative which would deny the ROW, no County approvals, but approve a CDCA Plan Amendment which would exclude wind energy development at the proposed site .

P344-120

3.4 Cultural Resources

123. Comments on this portion of the DEIS will be left for Native Americans those with more expertise than I.

P344-121

3.5 Environmental Justice

124. .

3.6 Lands and Realty

125. .

3.9 Multiple Use Classes

126. .

3.10 4.9 Noise

127. The DEIS text (3.10-1 makes reference to a NPS 2009 study related to noise, which is quoted directly below. Though unable to fins the full text of whatever the current status of the ongoing research is, Exhibit 38 provides a brief summary of the adverse impacts of noise on wildlife, with the only text from the NPS site that I could locate. P344-122

128. **Effects on Wildlife** (from www.nature.nps.gov/naturalsounds/impacts

> Functioning ecosystems depend on natural acoustical environments. Many animals, insects, and birds decipher sounds to find desirable habitat and mates, avoid predators and protect young, establish territories, and to meet other survival needs.
>
> Scientific studies have shown that wildlife can be adversely affected by sounds and sound characteristics that intrude on their habitats. Although the severity of the impacts varies depending on the species being studied and other conditions, research has found that wildlife can suffer adverse physiological and behavioral changes from intrusive sounds and other human disturbances. Some sound characteristics have been associated with suppression of the immune system and increased levels of stress-related hormones in animals. Studies have also shown that songbirds that live in places with increasing sound levels have to sing louder than birds in quieter environments, and not all species have the ability to adapt in this way. Birds forced to sing at a higher volume have to expend increased levels of precious energy to attract a mate or warn of predators. Bighorn sheep are less efficient at foraging for food when they are exposed to aircraft, and mountain goats often flee from the sound of helicopters and airplanes. Still other research has demonstrated that intrusive sound properties can adversely affect reproductive success in caribou and communication in whales. When these effects are combined with the other stressors faced by wildlife such as winter weather, disease, insect harassment, and food shortages, sound impacts can have important implications for the health and vitality of wildlife populations within a park. Click here for an Annotated Bibliography on the Effects of Noise on Wildlife. (Bibliography was not available online today.)

P344-123

129. The more detailed comments on this section will be provided by others. The human health impacts associated with wind turbine noise are discussed in this letter under the section on Public Health and safety below. P344-124

130. The proposed project is not located 5 miles west of Ocotillo as stated at DEIS 3.10-7, it is to the north, west and south of the community of Ocotillo. See earlier comments on incorrect location of project. The railroad has not been used and part of the track is paved over so there is no traffic by rail through the proposed project site. Therefore, it is inappropriate to list the trains traveling on the railroad (DEIS 3.10-8) as a source of noise. CONTINUE 4.9 P344-125

3.12 4.12 Public Health and Safety

131. In Sec. 3.12.1.3 Hazardous Materials there is again reference to meteorological conditions in El Centro (DEIS 3.12-2)an urban area that is surrounded my miles of irrigated agriculture with a different temperature and relative humidity scenario as discussed earlier. Temperatures in the Ocotillo area are often 10 degrees F higher on both winter and summer because there is no evaporative cooling/transpiration effect such as comes from agricultural fields and the extensive lawn irrigation in El Centro to the east. **P344-126**

132. In addition to the residents (sensitive receptors who are not being paid by project applicant), there are private lands which likely could and would be developed for residential purposes it there were NOT the OWEF proposal. OWEF essentially will preclude further residential development of adjacent and nearby private lands adjoining the BLM manages public lands where the proposed wind turbines are to be located. See DEIS 3.12-2 for text and DEIS Vol II Fig For location of private lands near the proposed OWEF proposed use of public lands managed by BLM. **P344-127**

133. DEIS 3.12-2 refers to the "Numi-Mirage development".Did no one do a fact check or reread of the text prior to public distribution? I have lived here for 34 years and have never heard of or seen any development identified as "Numi-Mirage". I presume that this is just a very sloppy reference to the residential community known as the NoMirage subdivision to the SE of Ocotillo. If the authors of the document can't get place names and locations correct, how much other information is similarly incorrect or misleading? **P344-128**

Valley Fever

134. Valley Fever (DEIS 3.12-5) fails to acknowledge that residents of Imperial County who have serious cases of valley fever are not being treated by physicians in Imperial County, but are traveling to Arizona for medical care by physicians more familiar with its treatment. One lab tech in El Centro told me about her relative that got violently ill following attending a ground-breaking ceremony in Imperial, and finally being diagnosed and treated in Arizona after physicians in Imperial County failed to diagnose his health problems. **P344-129**

135. OWEF would exacerbate the already adverse non-attainment air quality impacts from PM 10, ozone and the not mentioned increase in fungal spores capable of causing valley fever in this endemic area. See Exhibits 12 "Valley fever on the rise in California" , 13 "Infection hits California prison hard", and 14 information from CDC's MMRW showing endemic areas known for *Coccidioides immitis* in 2001. **P344-130**

136. The role of the amazing towering clouds of dust that have hit Arizona this summer and the chubascos with walls of dust in Imperial County hit home as I was a passenger on a flight on Oct 4, 2011 that was not permitted to land in Phoenix at the scheduled time because the intense dust storm made landing unsafe, planes were circling for some time. Even more amazing was hearing the story from the Phoenix resident sitting next tome as she told of how extremely ill she and several friends had been when they got valley fever last year. What surprised me most was how many people she knew who had been very ill with Valley fever after before the big clouds of dust of this year. Clearing more undisturbed desert soils in Cocci endemic areas such as public lands SW Imperial County will put even more people in both Imperial County and Arizona at risk of exposure to cocci spores and the resulting illness which can be very serious for some. **P344-131**

137. Based on independent research by Dr. Fred Cagle, the DEIS conclusions related to Valley Fever (DEIS 4.11-12) are woefully inadequate for an area considered to be endemic buy the CDC. Dr. Cagle (FC) was told by one "anonymous" physician that he couldn't discuss the incidence of valley fever in Imperial County "because it was bad for jobs". FC reported that a Valley pharmacist suggested that there are many, many cases of valley fever in the valley, based on prescriptions being filled. I was told of a family member with a very serious case of valley fever that he had had to go to Arizona for diagnosis and treatment. Earlier DEIS documents contained text warning about valley fever potential associated with the construction of the transmission lines across the Yuha ACEC. **P344-132**

138. Therefore, failure to seek diagnosis and/or treatment for Valley fever in Imperial County cannot be considered any reason able indicator of the prevalence or severity of the disease among residents of Imperial County. Count me among the many residents of Imperial County who have chosen to get medical care in San Diego County. Based on what I have learned about treatment of Valley fever, if I thought I had valley fever, I would seek treatment from an expert in Arizona, not in Imperial County. **P344-133**

139. Mitigation measure **PHS-9** appears absolutely irrelevant in eliminating any of the significant public health issues discussed in the DEIS and in these comments. Trash as a source of disease vectors is not the issue that concerns me. None of the issues discussed in these comments is addressed in these comments. **P344-134**

140. Re **PHS-6**, I strongly object to the use of any herbicides over the Ocotillo-Coyote Wells Sole Source Aquifer. I can find no justification for the application of herbicides in a part of the desert that would seem to have no need for such at this point in time. . **P344-135**

141. See also discussion in Sec. 4.1.5 Cumulative Scenario Approach and Cumulative Impacts near the end of these comments. **P344-136**

Shadow Flicker, Wind Turbine Syndrome (WTS) and Noise

142. Health associated problems related to shadow flicker and proximity to wind turbine generators as described under heading WTS have been documented in articles by health professionals in Europe, Canada, Australia and throughout the US, and not limited to the reports of Dr. Pierpont. See Exhibits 16 - 24. Dr. Pierpont's studies and writings are convincing to me as I will explain below. **P344-137**

143. Noise and infrasound have been documented as being extremely significant adverse impacts for some individuals There a re several recent papers by Dr. Salt that share research and concerns. (See Exhibits 32, 33. 34) Salt 2010 states that:

    144. Wind turbines such as those currently being constructed in rural areas **generate high levels of infrasound noise**. This is very low frequency noise (sound waves of less than 20 cycles per second) that **you cannot hear. Even though you cannot hear the sound, it is easily detected by the ear at the levels that are produced and can have effects on the body that profoundly disturb some individuals**. (Emphasis in original.) (Exhibit 33) **P344-138**

145. There is an excellent summary of health impacts associated with wind turbines, including issues from other countries in DuHamel's July 2011 article from a May newsletter by Doctors for Disaster Preparedness in the Tucson AZ press. (See Exhibit 35) **P344-139**

146. There are additional recent publications that discuss the potential for significant adverse **P344-140**

impacts of wind turbine noise by Punch et al, researchers at the Dept. of Communicative Sciences and Disorders at Michigan State University who interviewed people about experiences with wind turbines and wind turbine noise. (Exhibits 36, 37)

P344-140, cont.

147. In light of the considerable published information about adverse human health impacts, decisions must be made based on the precautionary principle rather than wait for what the DEIS at 4.11-13 calls "recognized regulatory guidance or thresholds related to WTS". The wind energy proponents ask the public to be as gullible about the potential for adverse health impacts associated with industrial scale wind turbines as the tobacco industry insisted related to the potential for adverse health impacts associated with smoking cigarettes. It took decades to change attitudes about tobacco use and the health impacts even from second-hand smoke cannot now be doubted. The information about adverse health impacts associated with proximity to wind turbines today is more than enough to justify erring on the side of public health and safety for the nearby community.

P344-141

148. I just returned from taking a Continuing Medical Education (CME) sold-out course for scientists, clinicians and health officials that was jointly sponsored by Columbia University College of Physicians and Surgeons and the Lyme Disease Association, Inc. In Philadelphia, PA from October 1, 2, 2011. I can assure anyone reading the DEIS that from the perspective of the hundreds of physicians and scientists attending the lectures and participating in the discussions at this CME course that case studies, even a case study reporting on the clinical course for even a single patient are information considered extremely valuable. Repeatedly, physicians were requested to write up and submit for publication case studies to increase the knowledge and understanding of others related to an extremely complex infectious disease course. Indeed, the medical literature related to Lyme disease and other tick-borne pathogens seems much based on very small studies and case reports. This is true even 30 years after the spirochete causing Lyme Disease was first identified. Different clinicians and different scientists have differing definitions for diagnosis and for what constitutes adequate or successful treatment for cure, or persistent infection. Yes, there are differences of opinion on how to treat and diagnose, but among those health care providers and researchers who either have Lyme disease themselves or have multiple family members with the disease, successful treatment for a cure and efforts to ensure that others not suffer decades of illness is what counts most. Waiting for consensus and large studies without serious deficiencies that have not provided consistent answers over 30 years makes no sense to those who are suffering or to those treating patients and family. Who wants to be the guinea pig that is denied treatment to be a control for a large "scientific" study? So, yes, I find the information on noise and wind turbine syndrome very convincing even if those who wish to profit from an industrial scale wind turbine project do not.

P344-142

149. Human health is a very individual issue, and different people will respond differently to noise and vibration. Indeed, the hearing of dogs and horses is far more sensitive than is human hearing. The impacts to farm animals, horses and dogs, though it may be considered case studies, when taken together with other similar accounts becomes very convincing. See Exhibits 30, 31 for Dr. Hanning's articles on sleep disturbance and wind turbine noise.

P344-143

150. And again, from a personal perspective, I cannot look at the turbines in the Palm Springs area without feeling motion sick, whether a passenger or driver on Interstate 10 or any of the other roads through the area. One wonders what the impacts related to the proposed OWEF turbines might be on those traveling on Interstate 8 or Hwy 2 in the vicinity of the turbines might be,

P344-144

not only the residents.

P344-144, cont.

Electromagnetic Fields

151. To state that NRC/NAS "concluded [in 1999] that EMF does not pose an unrecognized health hazard" and then cite a 1993 CPUC decision (DEIS 3.12-7) seems more than woefully inadequate and outdated in 2011 and ignores the body of evidence, case studies and publications in the past 18 years! Reading the 2010 book by Samuel Milham, MD, MPH entitled Dirty Electricity: Electrification and the Diseases of Civilization and the listing of the numerous publications on the subject after the date of the CPUC decision, leads one to a very different conclusion about the potential for adverse human impacts of exposures to electromagnetic fields that must not be ignored. In addition, see Exhibits 27, 28. These Exhibits were provided by the author and it is my understanding that they were submitted directly by the author as part of his comments for this DEIS..

P344-145

152. Even a more recent article about the possible link between exposure to electromagnetic fields and childhood asthma appeared this past August and refers to other health impacts also. See Exhibit 29.

> Exposure to electromagnetic fields has been linked to a number of health problems, including cancer and immune system and reproductive abnormalities, and now the latest research adds another concern to the list: childhood asthma. Read more: http://healthland.time.com/2011/08/02/microwaves-and-asthma-exposure-to-magnetic-fields-during-pregnancy-ups-asthma-risk-among-newborns/print/#ixzz1ZvoRYHPI

P344-146

153. With an opening sentence such as in the Time article, it is difficult to understand why the DEIS relied on such outdated information as identified at DEIS 3.12-7 to supply the public with unconvincing "assurances" of no potential for adverse impacts for those living, working, or recreating in the project vicinity.

P344-147

154. An authors draft of an article to be published is included as Exhibit 46 to prove that, contrary to assertions of wind energy proponents, there are many studies that describe the public health impacts of wind turbines on sensitive individuals.

P344-148

3.13 Recreation

155. Issues addressed by others.

3.14 Social and Economic

156. .

3.17 Transportation and Public Access

157.

3.18 Vegetation Resources

158. One of the most important sentences in the description of Environmental Setting" is where the DEIS states that: Despite the above-mentioned usage, the majority of the proposed OWEF site is relatively undisturbed." (DEIS 3.18-1)

P344-149

3.19 Visual Resources

159.

3.20 4.19 Water Resources

160. Again, the project is not located 5 miles west of Ocotillo (DEIS 3.20-1), it surrounds Ocotillo yo N, W, and S (DEIS vol II Fig. 1-1 Project location map. DEIS Vol II Appendix D Fig. 15 B and 15 D aerial photos showing the CDFG delineation impacts on figures that depict the location of homes in Ocotillo and Nomirage.) Continually misrepresenting the location of the proposed project in relation to the community it surrounds on three sides suggests that the authors of the DEIS failed to look at the figures in DEIS Vol II, and also that BLM and County staff failed to carefully review the document for even basic accuracy prior to its public release. **P344-150**

161. Table 3.20-1 provides data from IID, but fails to disclose the weather station where data was taken. What is the specific location of the data in Tab le 3.20-1? Temperatures in the Ocotillo area are warmer in both summer and winter than those from the irrigated areas where flood irrigation and sprinkle irrigation result in significant evaporative cooling and increased humidity. Anyone driving on Interstate 8 will notice the change in temperature at the interface of irrigated agriculture and the open desert where public lands meet privately owned irrigated farmlands. **P344-151**

162. After referring the reader to DEIS Vol II Fig 3.20-1 for surface waters and wetlands the text goes on to list surface waters that are off the figure and about 20 to 80 miles to the east and northeast of the proposed project site and fails to refer the reader to any figure depicting the location of the Colorado River or Salton Sea!! Why? All of the surface waters identified by name in the first paragraph of Sec. 3.20.1.1 are either downgradient from the proposed project site or so far distant that they are in no way related to the proposed project site, even in the most severe flooding conditions in the past 36 years! Therefore, in my opinion they are irrelevant for purposes of this DEIS unless the proposed road cutting and surface disturbances in the FEMA designated floodways would result in changed flows or drainage patterns on the way to the Salton Sea in the event of a major flood event such as occurred in 1976 and 1977. **P344-152**

163. Under the heading "Jurisdictional Drainages", refers to Sec. 3.18.1.4 where Table 3.18-4 shows 239.16 Ac of ACOE jurisdictions non-wetlands waters, and CDFG jurisdictional areas are 1,017.38 acres (DEIS 3.18-25). Text at DEIS 3.20-4 refers to the Biological Technical Report (BTR) at Sec. 3.2.4 and suggests that there is detailed technical data at that location in DEIS Vol II. In the hard copy of Vol II provided to me there is actually less information text format in the BTR than there is in Vol I and BTR Table 4 is identical to Vol I Table 3.18-4. Was there information in the BTR that was removed before the documents were distributed for public review? If so, why? **P344-153**

Groundwater

164. It is not anticipated that water would come from the local groundwater basin (OWEF DEIS 3.20-5) though approximately 50 AF of water would be needed for construction including concrete batching, road construction and dust control (OWEF DEIS 2-9). The groundwater text under the Water Resources section is not as specific as the discussion under utilities in Sec. 2. Proposed Action & Alternatives which very clearly states that: Investigation into alternative sources of water is ongoing, **but in no event will water from the Ocotillo-Coyote Wells Sole Source Aquifer (SSA) be used.**" (OWEF DEIS 2-9) (emphasis added) **P344-154**

165. This is reinforced in Sec. 4.19 where the DEIS 4.19-4 states that the Ocotillo-Coyote Wells SSA "is currently in a state of long-term overdraft." **P344-155**

166. The Ocotillo Coyote Wells Groundwater basin has long been identified as being overdrafted (USGS 1977 Skrivan Report) and was identified as being overdrafted in the most recent CEQA document for a project overlying the Ocotillo-Coyote Wells Sole Source Aquifer as follows: "The proposed project would generate wastewater and runoff pollutants that could potentially affect stormwater quality and/or groundwater quality. **The [CWSP] project will also produce groundwater from a basin identified as in a state of overdraft.**" (County of Imperial. 2010. DEIR Coyote Wells Specific Plan at p. 4.7-25) (emphasis added.) **P344-156**

167. Additional text from the CWSP DEIR repeats the fact that the County has acknowledged that the groundwater basin is overdrafted and that water levels in those portions of the basin where there are private wells that are monitored are declining, leading to the determination of overdraft. That additional CWSP DEIR text follows:

168. "MM 4.7.7 g The proposed project shall enter into a six-year groundwater management plan/agreement with the Imperial County Planning and Development Department to ascertain the potential impact the production of groundwater for the proposed project is having on the described **overdrafted basin**." (CWSP DEIR at 4.7-27) (emphasis added) **P344-157**

169. "Analysis of water-level data over time for Layer 1 and Layer 2 resulted in the observation of long term depletion of storage in the basin (Todd, 2007). Hydrographs of water level data for wells completed in the basin are characterized as having little (if any) seasonal fluctuation and as being primarily controlled by pumping demand in the basin. **Based upon this analysis, the basin has been designated as being in an overdrafted condition**. (Leighton, 2010)." (CWSP DEIR 4.7-10) (emphasis added)

170. The OWEF DEIS (3.20-8) also clearly concludes that the Ocotillo-Coyote Wells SSA is in a state of overdraft and cites documents related to the US Gypsum Expansion EIR/EIS. **P344-158**

171. In addition to the text from the CWSP DEIR and USG EIR/EIS and OWEF DEIR related to overdraft, I prepared an update of the USGS groundwater monitoring data in 2010 for submission as comments on the CWSP project. That table is included as Exhibit 39 with these comments. Table 10 shows changes in static water levels and changes in water quality for monitored wells and for wells previously monitored or measured by USGS. **P344-159**

172. When I spoke with staff at the DWR several years ago, I was told that the reason that the Ocotillo-Coyote Wells Groundwater Basin was not considered as being in critical overdraft (as noted at DEIS 3.20-6) was because the population overlying the groundwater basin was too small for the state to add the basin to the list of those critically overdrafted.. I cannot remember the name of the person with whom I spoke at DWR, nor the date of the phone conversation. **P344-160**

173. DEIS 3.20-8 states that the maximum contaminant level (MCL) for fluoride in drinking water is now 4.0 mg/L according to the EPA. It used to be 1.4 mg/L. Why has the MCL for fluoride been increased? Is it because many areas cannot meet the drinking water standards of the old 1.4 mg/L? The curious thing is that the EPA website sets the secondary MCL (or SMCL) for fluoride as 2 mg/L and includes the following text, again leaving me to wonder why the secondary MCL is half the primary MCL...economic??? **P344-161**

174. "Tooth discoloration and/or pitting is caused by excess fluoride exposures during the formative period prior to eruption of the teeth in children. The secondary standard of

2.0 mg/L is intended as a guideline for an upper bound level in areas which have high levels of naturally occurring fluoride. The level of the SMCL was set based upon a balancing of the beneficial effects of protection from tooth decay and the undesirable effects of excessive exposures leading to discoloration." (EPA.gov. Basic information about fluoride in drinking water, accessed 2011-10-05.)

P344-161, cont.

175. Originally the total dissolved solids standard for drinking water was 500 ppm. I was informed that it was increased from 500 ppm to 1000 ppm because many locations in Southern California and those relying on Colorado River water could not meet the standards of 500 ppm.

P344-162

176. For the different groundwater basins identified as being included within the Campo-Cottonwood Sola Source Aquifer, if is difficult to believe that there is inadequate information available to determine whether or not the basins are in overdraft conditions (DEIS 3.20-9, 10). DEIS 3.20-10,11 describe the groundwater resources of the Pine Valley Mutual Water Company from which groundwater is proposed as a source for the OWEF because Pine Valley is an area with high annual precipitation, water levels are not declining and the water company is currently permitted to supply water for other projects on non-overlying lands.. Something which would not be permitted if the basin were overdrafted. (DEIS 3.20-11).

P344-163

177. Where is any Figure depicting the location of the named groundwater basins of the Campo-Cottonwood Creek SSA? What figure depicts the location of the proposed source of groundwater in the Pine Valley area? If this is a proposed source of water, why doesn't the Figure for the proposed project location include the proposed groundwater source area?

P344-164

178. I reviewed the text of SB 610, Water Supply Assessment, and reach a conclusion different from that of the DEIS at 3/20-13. As I read the text of SB 610, the OWEF would constitute a "project" per Water Code Sec. 10912 because it is an industrial facility occupying more than 40 acres of land. The text of the DEIS ignores the words "OR" which is used twice in the sentence where is starts "proposed industrial...' ...occupying more than 40 acres OR ..." and the next to last bullet is followed by the word "or". Therefore, as I read the legislation the OWEF requires the preparation of a Water Supply Assessment (WSA).

P344-165

179. Elsewhere the County considers the proposed activities on the 26 acre private parcel as "industrial development (DEIS 4.6-4). So how could it be that the even larger and more intensive development for the proposed industrial scale wind turbine project on public lands would or could be considered anything other tnan industrial?

P344-166

180. Even the DEIS Vol II Appendix D BTR Figure 1 is entitled "Ocotillo Express Wind PROJECT" (emphasis added). BTR Fig. 3 Site Plan is for the "Ocotillo Express Wind PROJECT" (emphasis added). In fact, it appears that the Figures in the BTR refer to the proposed action as the "Ocotillo Express Wind PROJECT" (emphasis added), including the figures depicting the location of roads, turbines and permanent structures..

P344-167

181. OWEF DEIS is internally inconsistent in the manner in which is discussed the potential for use of the Ocotillo-Coyote Wells SSA over which the proposed project is located. The text related to use of "local public groundwater supplies which states that: "Local public water suppliers that could also provide operational water supply include Coyote Valley Mutual Water Company (125 existing connections), Ocotillo Mutual Water Company (80 existing connections), and Shell Canyon Water Company (16 existing connections) (B-E, 2004)." (OWEF DEIS at 3.20-15)

P344-168

182. That text is inconsistent with the assurances stated in OWEF DEIS Sec. 2. Proposed Action & Alternatives which very clearly states that: Investigation into alternative sources of water is ongoing, **but in no event will water from the Ocotillo-Coyote Wells Sole Source Aquifer (SSA) be used**." (OWEF DEIS 2-9) (emphasis added) **P344-169**

183. And "groundwater from the Coyote Wells Valley Groundwater Basin would not be used to meet construction water requirements." (DEIS 4.19-4). This statement fails to mention long term water use or dust suppression water source. **P344-170**

184. As noted elsewhere in these comments, the effectiveness of MgCl as a soil binder (DEIS 4.19-3) may be questionable because the temperature and humidity of the proposed project area more than 20 miles to the west of irrigated agriculture where humidity information was collected. If ineffective because of lower than anticipated relative humidity, will the area simply be dustier or will water or another chemical be used for dust suppression. If water, how much and from what source. **P344-171**

185. DEIS 4.19-4 refers to the Imperial Integrated Water Resources Management Plan (IRWMP) as being completed and in place. However, I am participating in the IRWMP Water Forum meetings which are ongoing with the next meeting scheduled for October 20, 2011. Accordingly I believe that the IRWMP has not yet been finalized, **P344-172**

186. As depicted in DEIS Vol II Appendix D, the figures giving details of proposed project components and road construction for access and construction appear to have the potential for some very serious alteration of flow/drainage during heavy rainfall events with runoff from the mountains of from the relatively impervious caliche layer through which the washes have cut. Therefore, as noted there could be serious adverse impacts to both drainage and infiltration of precipitation such has been observed at several failed BLM desert restoration project sites in the Yuha ACEC. Cutting through dozing or compacting and scraping caliche has had the unintended effect of altering infiltration so much that downgradient off-site desert shrubs and trees have died following the use of heavy machinery for unknown/or undisclosed attempts at revegetation. Howard Wilshire, retired geologist from USGS, and I visited and photographed several such failed BLM desert restoration/revegetation sites. I believe there are very serious questions about the potential for successful revegetation where caliche is at or near the surface, regardless of the nature of "temporary surface disturbing impacts such as road building, concrete batching and employee parking, assembly and staging areas. **P344-173**

187. Although the actual acreage directly impacted by such activities may appear small, the down-gradient and off-site impacts of such activities are likely to extend far beyond the direct visible surface impacts. The DEIS asserts that "groundcover" would be designed to maximize infiltration rates and minimize potential impacts to groundwater recharge (DEIS 4.219-5), but no details are provided and no references cited for groundcover successes at comparable sites in a low rainfall, hot dry desert. **P344-174**

4.19.10 Mitigation Measures Water Resources

188. In Sec. 4.19.10 Mitigation Measures identifies the BLM's Best Management Practices, but it is noted that each BLM contains the word "should" (DEIS 4.19-55, 56) rather than the word "shall" for each identified BMP. Indeed, the word "should" is used 27 times in the list of BMPs , once or more times in each sentence except where the phrase "may require" replaces should. Should implies a recommendation, a request in a polite manner, what is expected, what is probable, rather than what is required or mandatory as when using the word **P344-175**

"shall".which implies obligation or promise or requirement. To me, the BLM BMP's sound voluntary rather than obligatory or mandatory. Is that because there will be little or no oversight by BLM to ensure compliance with BMPs, or does BLM not really care? If voluntary or unenforceable and without penalties for failure to implement, the BMPs are just a collection of recommendations on a piece of paper.

P344-175, Cont.

189. Note that the Project Specific Mitigation Measures contain the word "shall" (DEIS 4.19-56) rather than the word "should" or "should be".

P344-176

4.19.9 Cumulative Impacts Water Resources

190. The Coyote Wells Specific Plan project is NOT a residential development and the OWEF DEIR once again intentionally misrepresents the true nature of that proposed project and its potential groundwater use to such an extent that the credibility of the entire OWEF DEIS is questionable. How could any County planner have reviewed the OWEF and not been aware of the gross misrepresentation of the CWSP project which the County approved in December 2010, and which is now the subject of two lawsuits? (See Exhibits 8 - 11 for information about the CWSP .)

P344-177

191. The OWEF DEIS further mischaracterizes the cumulative impacts to the groundwater resources of the Ocotillo-Coyote Wells Groundwater Basin SSA by omitting the export of groundwater from the three wells owned and operated by the US Gypsum Company and exported by pipeline to its wallboard factory at Plaster City, many miles to the east of the SSA boundaries. The County approval of the US Gypsum wallboard expansion project and the approval of the Planning Director's determination of USG historic use of 767 AF/Y for export are also the subject of ongoing litigation. Exhibit 40 is a copy of the Appellate Court decision which discusses the US Gypsum groundwater use and the inflated values asserted, but for which there was no production or pumping data to support the prior use of 767 AF/Y. Exhibit 41 is a copy of the 2006 Well Registration letter citing 767 AF/Y as US Gypsum's historical use of groundwater. The US Gypsum wells are located between the communities of Ocotillo and NoMirage.

P344-178

192. The OWEF DEIS also omits and fails to mention the permitted groundwater pumping and location of water wells overlying the groundwater basin and which supply water to the sand and Gravel companies with quarries located at the base of the Coyote Mts. Wilderness to the north and west of Ocotillo. Water use by the sand and gravel operations is estimated to be in excess of 125-150 AF/Y. Exhibit 45 is a 1991 map depicting the locations of wells and the faulting in the geology in the portion of the SSA where the majority of domestic wells and USG wells are located. Exhibits 43 and 43 are tables of groundwater use by US Gypsum and others for the CEQA/NEPA documents for the USG expansion project. Exhibit 44 is a table I prepared for comments on another project, by identifying the quantity of water to be used at different locations within the Ocotillo-Coyote Wells SSA.

P344-179

193. No matter what the OWEF DEIS may assume about the source for water at the Plaster City factory, it is still groundwater being exported from the SSA because BLM has not issued its Record of Decision on the 2008 Final EIS for the US Gypsum project. Why? Because US FWS still has n ot issued its Biological Opinion, and without the Biological Opinion, BLM cannot issue a Record of Decision to approve a right of way for Colorado River water from the Imperial Irrigation District to be transported by pipeline from the West Side Main Canal to the Plaster City Factory. Daniel Steward (1760-337-4424), the BLM El Centro Field office

P344-180

Resources Branch Chief will verify this analysis. **P344-180, cont.**

194. So why does the OWEF DEIS omit information available in CEQA/NEPA review for the US Gypsum expansion project and for the Coyote Wells Specific Plan - Law Enforcement and military training facility!? How much other important information related to cumulative impacts to water resources is either missing or misrepresented? **P344-181**

3.22 Wildland fire ecology

195. .

3.23 4.21 Wildlife Resources

196. The Exhibits 47, and 48 related to bats and wind turbines are being included as exhibits with these comments as the request of Sco1tt Cashen. Exhibit 49 is a table of recommended survey methods for bats by species. Exhibit 50 is an article about wind turbines killing thousands of birds and bats every year and mentions wind turbines owned by Pattern Energy. **P344-182**

197. Detailed comments on biological resources are being submitted by Scott Cashen and others. However, having lived in the Yuha Desert for the past 34 years, I believe that the proposed project area is one of incredible biological diversity and very little disturbed compared to other public lands managed by BLM in Imperial County. **P344-183**

198. Creating new roads for heavy machinery, compacting soil resources and excavating for the installation of turbines and creating areas for permanent structures and temporary storage areas cannot help but have adverse impacts on all animal species in close proximity, or even more distant. Dust generated by activities will decrease photosynthetic activity and therefore forage value and productivity in an area with such scarce rainfall to rinse the accumulated dust from vegetation. The noise and vibrations will be transmitted through the ground and have adverse impacts on burrowing animals, be they mammals, reptiles and amphibians in addition to birds. Ant colonies will be crushed and destroyed, impacting the very specialized food source for the flat-tailed horned lizard. Noise and vibrations are likely to adversely impact mating and impact predator/prey relationships. As noted elsewhere, many animal species are far more sensitive to sounds than are humans. All aspects of the proposed wind turbine project will have the potential for adverse impacts on wildlife. **P344-184**

Sec. 4.1 Environmental Impacts/Effects

199. The DEIS describes the types of impacts from a proposed project kin the following general terms.

200. "Direct effects are caused by the action and occur at the same time and place as the action; indirect effects are caused by the action and occur later in time or further in distance, but are still reasonably foreseeable (40 CFR 1508.8). Cumulative impacts are those effects resulting from the incremental impacts of an action when combined with other past, present, and reasonably foreseeable future actions (regardless of which agency or person undertakes such actions) (40 CFR 1508.7). Cumulative impacts could result from individually insignificant but collectively significant actions taking place over a period of time. " (DEIS 4.1.1) **P344-185**

201. DEIS notes that the applicant will be required to comply with the requirements of the mitigation measures and failure to comply with implementation "may affect the approval status of the ROD. (DEIS 4.1-3) However, as Ocotillo and East County residents have recently **P344-186**

documented, there have been many instances on non-compliance with the BLM ROD for the approval of Sunrise Powerlink, but the ROD has not been terminated. BLM quietly seemed to ignore the instances of non-compliance, and it was not until Supervisor Diane Jacob wrote to the CPUC that any action was taken, but seemed to be merely an inconvenience as Transmission line construction appeared to be on-going as I passed the In-Koh-Pah Powerlink fenced off work site with the vegetation scoured from the site

P344-186, cont.

202. With what frequency would the mitigation measures "be monitored and managed by BLM" (DEIS 4.1-3) ? How will BLM enforce compliance with terms of any ROD? Would it be with regular, unannounced inspections by knowledgeable staff or would enforcement have to wait for public documentation of non-compliance or violations?.

P344-187

4.1.5 Cumulative Scenario Approach and Cumulative Impacts

203. "The cumulative effects analysis highlights past actions that are closely-related either in time or space (i.e., temporally or in geographic proximity) to the Proposed Action, present actions that are ongoing at the same time this EIS/EIR was being prepared; and reasonably foreseeable future actions, including those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends." (DEIS 4.1-4)

P344-188

204. Table 4,1-1 Cumulative Projects list beginning at DEIS 4.1-6 is bizarre, inaccurate and misleading. It includes projects hundreds of miles away, including in Nevada. The list does, however, make it painfully clear that the southern California deserts and rural East County San Diego are being considered for destruction on a massive scale, a national sacrifice area.

P344-189

205. I do not have time to fact check the details of the 88 projects and ownership identified and the 4 additional pages of unnumbered projects in DEIS 4.1-6 to 4.1-19.. However, if Project #40 Coyote Wells (Wind Zero Group, Inc) is an example of the accuracy of the information provided, I can assure decision makers that the information is both erroneous and misleading. This is not a residential project and was never intended as such. The Imperial County Board of Supervisors approved the Coyote Wells Specific Plan (CWSP) Project on December 21, 2010 over the objections of the public. According to the DEIR for the Coyote Wells Specific Plan Project, nine (9) is the number of permanent residents expected at build-out of the project, hardly making it be considered as a residential project. (CWSP DEIR 4.10-11) (CWSP FEIR Findings 1.2.3 p.5)

P344-190

206. Thus, the "Project Type", "status", and "Project Description" for the Wind Zero project are all incorrect and misleading as of the June 2011 date on the OWEF DEIS/R, a joint BLM/County NEPA/CEQA document. One wonders why the County chose to approve the inclusion of such erroneous information in the OWEF.

P344-191

207. The CWSP has always had as its main focus the Wind Zero Law Enforcement Training Facility, or as the final documents asserted a private "military" training facility. Exhibit 8 includes five pages from the Planning Commission Project Report for the Coyote Wells Specific Plan and a copy of the cover page of the Final EIR dated July 2010. Exhibit 9 is a copy of the news article in Imperial Valley Press following the Board's approval of the Wind Zero project. Exhibit 10 is an article in the San Diego Reader about the lawsuit being filed to halt the Wind Zero's proposed military training facility. Not only did environmental organizations file a legal challenge, but the Quechan Tribe also filed a legal challenge to the County's Approval.

P344-192

208. Given the misinformation related to the CWSP and Wind Zero Training Facility, one must question how many other projects included in the Cumulative Projects list are similarly misleading or outright errors. **P344-193**

209. Why is there no status provided for #85 Campo Wind Energy Project and #86 Manzanita Wind Energy Project at DEIS 4.1-15? **P344-194**

210. There is no place in the Table 4.1-2 re cumulative analysis for the potential of surface disturbing activities (DEIS 3.12-5) to result in airborne fungal spores of Coccidioidomycosis immitis the causative agent of Valley fever in SW Imperial County which is an endemic area for the pathogen (Exhibit 14 p.2), with many residents of the County already suffering from valley fever, but receiving medical care in San Diego or Arizona. Why is this not included in either air resources or public health and safety in Table 4.1-2 Scope of cumulative analysis? (DEIS 4.1-20 to 4.1-22)? **P344-195**

211. There is a heading for "**Valley Fever**" under Sec. 3.12.1.5 Public Health Concerns at DEIS 3.12-5), but Table 4.1.2 has no identification for any Public Health and Safety Cumulative impacts issues to be considered other than "Waste Disposal Facilities" at DEIS 4.1-21 even though DEIR 4.11-10 states that the proposed project would occur in an area favorable to growth of the valley fever vector or fungus! **P344-196**

212. As noted in discussion of Public Health and Safety issues elsewhere in these comments, there is a considerable body of published materials in the media and by the Centers for Disease Control in their publications Emerging Infectious Diseases, several of which are included as exhibits with these comments. Clearly, from published materials, Valley fever is or can be a very serious and extremely expensive illness and healthcare issue, especially for low income communities and their public hospitals even though the DEIS at 4.11-10 is dismissive of the number of cases and their severity in Imperial County.. **P344-197**

213. Of particular concern is the acknowledgment of possible "adverse community impacts", and "the ability of communities [such as Ocotillo surrounded on three sides by the OWEF project] to absorb impacts" (DEIS 4.1-22) See earlier discussions of the potential health impacts that are of real concern to community members. Failing to include any of the numerous health impacts that have been associated with wind turbine projects elsewhere and with Exhibits appended to these comments, it seems an insult to the residential community to ignore documented health problems. Many of local residents already have serious health problems and they have informed both the County and BLM that they are concerned that proximity to the wind turbines which would surround the community on three sides if approved will only exacerbate already serious health problems. **P344-198**

4.22 Irreversible and Irretrievable Commitment of Resources.

214. OWEF would unnecessarily consume an incredible quantity of fossil fuel, and raw materials for transportation, construction and installation. Far more than should ever be used for any project to provide power to the remote coastal urban areas in San Diego County, and require the expenditure of additional quantities of raw materials, and transportation for the construction of the Sunrise Powerlink. A review of the DEIS suggests that much of the material would not be recycled or reused after the life of the project. **P344-199**

215. And the DEIS acknowledges that there could be an "unavoidable destruction of natural resources if the project is constructed at the proposed site on relatively undisturbed Public **P344-200**

lands. (DEIS 4.22-1)

P344-200, cont.

216. I found no place where the DEIS provided any analysis of materials used for this proposed project as compared to materials that would be used to provide comparable renewable energy if there were distributed generation and or conservation and reduction of per capita energy use in the more coastal urban areas.

P344-201

217. The DEIS asserts "The OWEF is a renewable energy project intended to generate wind energy to reduce reliance on fossil fuels" (DEIS 4.22-1) However, at no place could I find the location and generating capacity of even a single electrical generating facility that would be decommissioned or dismantled if the OWEF is approved and constructed. Where are the locations and what is the generating capacity and fuel source for each of the fossil fuel electrical generation facilities that will be closed.

P344-202

218. In the absence of such information it would appear that the proposal is merely an attempt to increase electrical generation/consumption and that the real motives may well be investor profits and getting federal monies or loan guarantees. This project may just be as temporary as the Imperial Valley Solar/Solar Two project which was approved by the CEC and BLM last year. To the concerned public, Solar Two did not seem a viable technology or project at the proposed site. However, the public, state and federal staffs wasted an incredible amount of time, energy and financial resources because we were all required to take the project seriously.

P344-203

219. Public Lands managed by BLM are more valuable as a resource for future generations if this project is denied, no ROW granted and a BLM Plan Amendment determines that the site is not to be considered as a potential site for any future wind energy project.

P344-204

4.23 Short-term uses of Man's Environment and Maintenance/Enhancement of Long-term Productivity

220. The use of the site for energy production is repeated again by the DEIS. But once again there is no reference to any location, source or quantity of fossil fuel electrical generating facilities that would be removed. Without such information there can be no credible argument that the proposed OWEF.

P344-205

221. Without providing information about fossil fuel facilities to be removed from production, there is no evidence that the proposed OWEF would actually reduce carbon based emissions more than the amount of carbon that might be released from impacts to the desert soils and disturbances to the carbon sequestered in caliche during the times when there was more abundant rainfall and more vigorous vegetative growth that supported the megafauna of the desert including Anza Borrego State Park to the immediate west and to the north. See discussion elsewhere in this letter and also the appended exhibits.

P344-206

4.24 Growth-Inducing impacts

222. The DEIS is once again dismissive of the local impacted community of Ocotillo which is surrounded on three sides by the proposed project. Of course, the proposed OWEF will have a very negative impact on the closest community and it is likely that not only will property values decline, but that once the present elderly residents move away or die that their properties will either be abandoned or become more run-down because the community would no longer seem a potentially desirable place to live.

P344-207

223. This section of the DEIS did not even use the word Ocotillo once, and failed to acknowledge

P344-208

that the majority of the community is undeveloped private lands. The proposed OWEF will likely effectively discourage or prevent new homes from being constructed on private land that is adjacent to the public lands with turbines. The OWEF appears to be a "community killer" because sentiment against the project is so intense.

P344-208, cont.

4.6 Lands & Realty Changes to the County General Plan and Zonking would constitute "spot zoning"

224. I am confident that both the County and BLM understand that the majority of the private land (in the Ocotillo and Nomirage areas and the larger surrounding area) remains as undeveloped land and there is absolutely NO buffer between this undeveloped private land and the proposed Wind turbine sites as depicted in the Vol II App D figures 14A-D and `15-D which depict the location of the wind turbines. I believe that if wind turbines are places near these undeveloped private lands that is id highly probable to almost certain that those private lands will be developed

P344-209

225. The County General Plan becomes a meaningless document if every time a property owner or project applicant wants to engage in an activity that is not permitted that the County rewards the project applicant to the detriment of adjoining property owners. The County should NOT change the zoning or General Plan for the benefit of RH, because it would be to the detriment of others. Changing the zoning and/or approving a General Plan Amendment (DEIS 4.6-3) appears to be a classic example of Spot Zoning and would mean that the property could be used for other inconsistent and incompatible uses in the future. For as along as I can remember, RH has been trying to get the zoning for his property changed. He is only a part time resident and given the fact that he intends to permit a wind turbine on his property (for what he informed the community was a sizeable amount of money), in the face of widespread community opposition, the requested General Plan Amendment seems inappropriate.

P344-210

226. This is especially true because the County is not changing the Agricultural zoning on lands for which the County has approved solar developments. If solar projects are considered to be farming or harvesting solar energy, then the wind turbine on private property designated residential could be said to be housing or providing a place for a wind turbine to reside if such a project is approved. Then when the project is abandoned, there would not be a parcel of land at the western portion of thbe private lands west of Ocotillo with incompatible zoning or land use designation . Spot zoning should not be approved and the County General Plan and the Ocotillo Nomirage Community Area Plan (ONCAP) should not be amended for the benefit of a single property owner to the detriment of others in the community.

P344-211

227. Sec. 4.6 describes the proposed use of the 26 acre private parcel as "industrial development" (DEIS 4.6-4, yet elsewhere the DEIS adamantly insists that the proposed OWEF is not an industrial development. Pleaser note that the proposed S-1 zoning would authorize many other types of activities without a Conditional Use Permit.

P344-212

228. Describing the 26 acre parcel as industrial use provides additional information for the requirement of the need for a Water Supply Assessment pursuant to SB 610. It makes no sense for the county to consider the proposed activities on the 26 acre private parcel as "industrial development (DEIS 4.6-4), but not consider the even more intensive developmetn components of the proposed project on public lands as not being industrial.

P344-213

Appendix H: Traffic Impact Analysis

229. The traffic Impact Analysis discussion under Cumulative Projects (App H p. 35) refers to Figures 8-1 and 8-2 which graphically depict the locations of "Cumulative Project Locations in San Diego and Imperial Counties. The last sentence in Sec 8.2 states that "The list of

P344-214

cumulative projects that were reviewed is included in Appendix D." (Appendix H at p. 35.) However, when one located Appendix D "Cumulative Projects Information the only information is for the Coyote Wells Specific Plan Trip Generation. 4.13 Transportation and Circulation. So where are the identifying identities of the scores of circles and numbers on Figures 8-1 and 87-2? Did anyone at BLM or the County ever reviewed this document prior to public release to realize that the referenced Appendix failed to include the stated information?

P344-214, cont.

Out of time to complete review of the DEIS and its technical appendices. What is have reviewed is more than woefully inadequate and contains such gross errors that it is difficult to believe that it was reviewed by either BLM or County staff prior to public release.

The only reasonable action for BLM if it does not deny the proposed ROW outright is for the DEIS/EIR to be revised, corrected and recirculated for the full comment period. Nevertheless, I urge bLM to recommend Alternative 5, to deny the ROS, and Amend the CDCA Plan with a determination that the site is unsuitable for wind energy development.

P344-215

Thank you for considering these comments on this ill-advised proposed OWEF project on some really wonderful public lands managed by BLM in southwestern Imperial County.

Respectfully submitted,

Edie Harmon

Table of missing of deferred "plans" for OWEF proposed project in Imperial County

Name of deferred plan	Identified at DEIS pg
Spill Prevention Containment & Countermeasure Plan & Monitoring	3.12-8, 10; 4.19-60
Construction Waste Management Plan	2-19
Restoration Plan	2-19
Noxious weed control Program	2-19
Integrated Weed Mgmt Plan	v. II App D 92
Integrated pest management Program	2-20
Traffic Management Plan	2-18
Transportation Plan	2-18
List of BMP will be developed but sound voluntary	2-18;4.19-55, 56
Storm Water Pollution Prevention Plan	2-18, 4.19-60
Cultural Resource Monitoring and Mitigation Plan	2-19
Fugitive Dust Control Plan	4.2-21
Dust Abatement Plan	2-18
Avian & Bat Protection Plan & Eagle Conservation Plan	2-17; VII App D 97-98
Decommissioning Plan	2-16
Fire Management Plan	3.12-4
Construction, Operation & Maintenance (COM) Plan	3.12-4
Risk Management Plan	3.12-10
Hazardous Materials Business Plan	3.12-10
Hazardous Materials Release Response Plan	3.12-10
Construction Waste Management Plan	3.12-11
Water Supply Contingency Plan for construction	4.19-57
Groundwater Monitoring and Reporting Plan	4.19-57
Drainage design, hydrologic & hydraulic analysis	4.19-58
On-site drainage improvements plan	4.19-58
Drought Water Management Program	4.19-59, 4.19-17,
Water Conservation Education Program	4.19-59; 4.19-17
Construction site Dewatering management plan	4.19-58; 4.19-17

Sedimentation and Erosion Control Plan	4.19-60
Habitat Restoration/Revegetation Plan	VII App D 91
Property Assessment Report	VII App D 94
Raven Control Plan	VII App D 95
Wildlife Mortality Reporting Program	VII App D 96
Burrowing Owl Mitigation & Monitoring Program	VII App D 97
Eagle Conservation Plan	VII App D 97
Bighorn Sheep Mitigation & Monitoring Program	VII App D 98
Lake & Streambed Alteration Plan	VII App D 91

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Exhibits

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2. BLM Site map for Ocotillo Express Wind CACA 05155
3. County NOP Scoping Notice with site plan Figure
4. BLM website with info re Ocotillo Wind Express
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35 The health hazards of wind turbines

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44 Water use at build-out in the Ocotillo-Nomirage Community Area Plan by EH

45 1991 EH map depicting the locations of wells and the faulting in the geology in the portion of the SSA where the majority of domestic wells and USG wells are located.

46 Phillips, C.V. 2011. "Properly interperting the epidiemological evidence about the health effects of industrial wind turbines on nearby residents". Bulletin of Science Technology and Society Vol 31 No. 4, 303-315. (Author's copy is a draft of 43 pages.)

47 Kunz et al 2007."Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document" The Journal of Wildlife Management, Vol. 71, No. 8 (Nov., 2007), pp. 2449-2486

48 Horn et. Al. 2008 "Behavioral Responses of Bats to Operating Wind Turbines".Journal Of Wildlife Management 72(1):123–132; 2008

49 Recommended survey methods for bats

50 Wind farms and deadly skies: Turbines on Texas coast killing thousands of birds, bats every year

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT NEWS RELEASE
California Desert District

Release Date: 12/18/10
Contacts: Dave Brown, (951) 697-5220 or Steve Razo , (951) 697-5217

News Release No. CDD-11-16

BLM Initiates Environmental Review of Proposed Wind Energy Project; Scoping Meetings Scheduled for Ocotillo and El Centro

The Bureau of Land Management (BLM) has published a notice of intent (NOI) to conduct an environmental review on the impacts of the proposed Ocotillo Express Wind Energy Project in Imperial County, Calif., and will hold public scoping meetings for the review in Ocotillo and El Centro in early January.

Ocotillo Express, LLC has applied to the BLM for a right of way (ROW) on public lands to construct a wind generation power plant facility approximately five miles west of Ocotillo (20 miles west of El Centro). The project would generate 550 megawatts of wind energy on 19,000 acres (23.4 square miles) of mostly public lands administered by BLM, as well a small portion of land within the jurisdiction of Imperial County.

The BLM and Imperial County intend to prepare a joint Environmental Impact Statement (EIS) and Environmental Impact Report (EIR), along with a proposed amendment to the California Desert Conservation Area (CDCA) Plan (1980, as amended) and are seeking public comments to identify issues to be analyzed. At present, the BLM has identified the following preliminary issues: air quality, biological resources, recreation, cultural resources, water resources, geological resources, land use, noise, paleontological resources, lands with wilderness characteristics, public health, socioeconomics, soils, traffic and transportation, visual resources, and other issues.

The BLM will be soliciting public comments through Friday, Jan. 21, 2011. Public scoping meetings will be held at the County of Imperial Board Room, 940 Main Street, Suite 211, El Centro, CA 92243 on Wednesday, Jan. 5, 2011 at 6 p.m., and at the Ocotillo Community Center, 268 West Imperial Hwy, Ocotillo, CA 92259 on Thursday, Jan. 6, 2011, at 5 p.m. The BLM and Imperial County will use the public scoping comments to prepare a draft environmental documents to be available for public review later in 2011.

Further details on the proposed wind energy project can be found at the following website: http://www.ca.blm.gov/ocotillo. Comments may be submitted to BLM Project Manager Cedric Perry by e-mail at cedric_perry@ca.blm.gov or by mail to the California Desert District Office, 22835 Calle San Juan de Los Lagos, Moreno Valley, CA 92553.

--BLM--

California Desert District 22835 Calle San Juan de Los Lagos, Moreno Valley, CA 92553

Last Updated: 12-16-2010

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Imperial County
Planning & Development Services Department

NOTICE OF PREPARATION OF DRAFT EIS/EIR FOR OCOTILLO EXPRESS WIND ENERGY PROJECT AND NOTICE OF PUBLIC EIS/EIR SCOPING MEETINGS

The Imperial County Planning & Development Services Department intends to prepare an Environmental Impact Report (EIR) for the proposed Ocotillo Express Wind Energy Project, as described below. Public scoping meetings for the proposed EIR will be held by the Imperial County Planning & Development Services Department and the Bureau of Land Management (BLM) on Wednesday, January 5, 2011 at 6:00 p.m. at the Board of Supervisors Chambers, 2nd Floor, County Administration Center located at 940 Main Street, El Centro, CA 92243 and Thursday, January 6, 2011 at 5:00 p.m. at the Ocotillo Community Park located at 266 West Imperial Highway, Ocotillo, CA 92259. Comments regarding the scope of the EIR will be accepted at this meeting. An Environmental Evaluation Committee Meeting will be held on January 5, 2011 at 1:30 p.m. where the project will be presented as an informational item. Also, a National Environmental Policy Act Environmental Impact Statement (EIS) will be prepared to address the Applicant's request for grant of right of way through BLM lands.

SUBJECT: Ocotillo Express Wind Energy Project EIS/EIR

BOARD OF SUPERVISORS APPROVAL: To Be Determined.

PROJECT LOCATION: The proposed wind energy facility site is located on BLM-administered lands and private land within the unincorporated area of the County of Imperial, in the vicinity of the unincorporated community of Ocotillo. A portion of the Imperial Highway runs through the proposed project site in a northwest to east direction, as well as the Interstate 8, which crosses a portion of the southern area of the proposed project site.

PROJECT DESCRIPTION: The proposed project is the development of a wind energy facility on approximately 15,000 acres of open space and undeveloped range land. The proposed project would include wind turbine generators, operations and maintenance building, project substation, meteorological stations, underground electrical collector system, access roads, and fencing. The electric generating facility would connect to the new SDG&E Sunrise Powerlink 500-kV transmission line scheduled for completion in June 2012.

URBAN AREA PLAN: Ocotillo-Nomirage Community Area Plan

BOARD OF SUPERVISORS DISTRICT: District 2, Supervisor Jack Terrazas

ANTICIPATED SIGNIFICANT EFFECTS: The EIS/EIR will analyze potential impacts associated with the following: Air Resources; Climate Change; Cultural Resources; Cumulative Impacts; Environmental Justice; Lands and Realty; Mineral Resources; Multiple Use Classes; Noise; Paleontological Resources; Public Health and Safety; Recreation; Social and Economic Issues; Soil Resources; Special Designations; Transportation and Public Access; Vegetation Resources; Visual Resources; Water Resources; Wildland Fire Ecology; and Wildlife Resources.

COMMENTS REQUESTED: The Imperial County Planning & Development Services Department would like to know your ideas about the effects the proposed project might have on the environment and your suggestions as to mitigation or ways the proposed project may be revised to reduce or avoid any significant environmental impacts. Your comments will guide the scope and content of environmental issues to be examined in the EIS/EIR. Your comments may be submitted in writing to: Angelina Havens, Planner III, Imperial County Planning & Development Services Department, 801 Main Street, El Centro, CA 92243. Available project information may be reviewed at this location.

NOTICE OF PREPARATION REVIEW PERIOD: December 21, 2010, through January 25, 2011.

El usted requiere esta información en español, por favor de llamar al (760) 482-4236.

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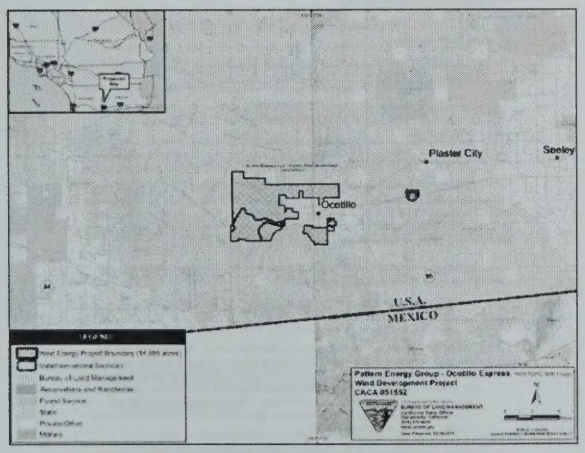

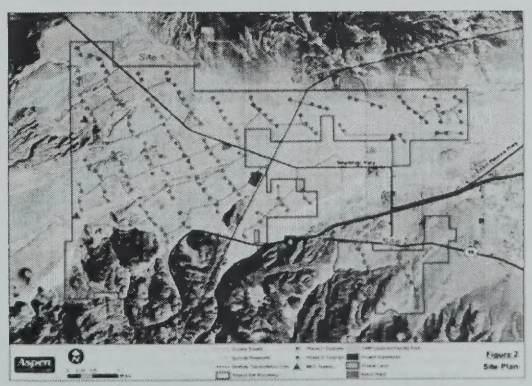

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT
California
El Centro Field Office

Ocotillo Express Wind Energy Project

CASE FILE NUMBER: CACA051552
DOCUMENT NUMBER: CA-670-2010-032

- **Ocotillo Express, LLC** has applied to the BLM for a right-of-way (ROW) on public lands to construct a wind generation power plant facility approximately five miles west of Ocotillo.
- The project would generate **550 megawatts** of wind energy, and includes a substation; administration, maintenance and operations facilities; transmission; and temporary construction lay down areas.
- **15,000 acres** of public land administered by the BLM, with a small portion of public land under the jurisdiction of Imperial County.
- Construction will occur in **two phases**: Phase I would produce approximately 229 MW; Phase II would produce 231 MW.
- The recently approved **Sunrise Powerlink** transmission line crosses the proposed site and will help to deliver the power generated by the **Ocotillo Express** project to energy consumers throughout Southern California.

The Draft EIS/EIR will be circulated for a 90-day public comment period. All comments must be postmarked no later than 10/5/11, 90 days from the date the Notice of Availability for the Draft EIS/EIR published in the Federal Register by the Environmental Protection Agency. Comments may be sent to Cedric Perry, Project Manager, by mail: 22835 Calle San Juan De Los Lagos, Moreno Valley, CA, 92553; phone: (951) 697-5388; or email cperry@blm.gov.

DEIR / DEIS

Draft Environmental Impact Report - Draft Environmental Impact Statement
The Draft EIR/EIS is posted on the Imperial County Planning and Development website

Scoping Report and Appendices
8/16/2011

Scoping Report
Appendix A-1: Notice of Preparation
Appendix A-2: NOI - Federal Register
Appendix B-1: Press Release
Appendix B-2: Public Notice
Appendix C-1: Fact Sheet
Appendix C-2: Public Comment Card
Appendix C-3: Scoping Meeting Presentation
Appendix D-1: Sign-in and Speaker Registration List 1/5/11
Appendix D-2: Sign-in and Speaker Registration List 1/6/11
Appendix E: Summary Transcript 1/5/11
Appendix F: Summary Transcript 1/6/11
Appendix G: Comment Letters

Related Links

Path of Development, 3/16/2011
Press Release 12/17/2010
Proposed Project Map
BLM Project Status
Imperial County Planning and Development

Bureau of Land Management
El Centro Field Office
1661 S. 4th Street
El Centro CA 92243
Phone: (760) 337-4400
Fax: (760) 337-4490
Office Hours: 8:00 a.m. - 4:30 p.m., M-F
Contact us by Email

A Summary of new evidence:

Adverse health effects and industrial wind turbines

August 2011

Carmen M.E. Krogh, BScPharm

Brett S. Horner, BA, CMA

To whom it may concern

In previous communications, evidence has been provided regarding the risk of adverse health effects and industrial wind turbines (IWTs). Up to now, the siting of IWTs in Ontario is based on predictive computer modelling. While there is ample evidence regarding adverse health effects, the conduct of human health studies to determine regulations for setbacks and noise levels that protect health is still lacking.

The purpose of this document is to inform authorities and decision makers of new evidence, including articles published in peer reviewed scientific journals which advance knowledge on the topic of adverse health effects of IWTs.

Based on the evidence compiled in this document, no further IWT projects should be approved in proximity to humans until human health studies are conducted to determine setbacks and noise levels that will ensure the health and welfare of all exposed individuals.

Furthermore where there are reports of adverse health and/or noise complaints IWTs should be decommissioned until the human health studies have been conducted to determine regulations for setbacks and noise levels that protect health.

This summary may be used and submitted by other individuals.

No financial compensation has been requested nor received for this summary.

Denial of adverse health effects

For years now, the Canadian Wind Energy Association (CanWEA) has denied that wind turbines can cause adverse health effects. However, based on previously known and recent information, this denial is incorrect.

A 2008 CanWEA media release informs the world "Scientists conclude that there is no evidence that wind turbines have an adverse impact on human health." [1] None of references included in this CanWEA media release state "there is no evidence that wind turbines have an adverse impact on human health."

An April 2009 CanWEA fact sheet states "Findings clearly show that there is no peer-reviewed scientific evidence indicating that wind turbines have an adverse impact on human health." [2] The fact sheet contains eight references, none of which state "there is no peer-reviewed scientific evidence indicating that wind turbines have an adverse impact on human health."

A 2009 CanWEA convened literature review concludes "Sound from wind turbines does not pose a risk of hearing loss or any other adverse health effect in humans." [3] However, the contents of the literature review contradict this conclusion by acknowledging IWT noise

may cause annoyance, stress and sleep disturbance and as a result people may experience adverse physiological and psychological symptoms. The literature review acknowledges possible symptoms include distraction, dizziness, eye strain, fatigue, feeling vibration, headache, insomnia, muscle spasm, nausea, nose bleeds, palpitations, pressure in the ears or head, skin burns, stress, and tension.

The above CanWEA sponsored statements which deny risk of adverse health effects are scientifically incorrect.

Assertions that IWTs do not pose a risk to human health only serve to confuse authorities and the public on the issue wind turbines and health effects.

For example, Ontario Minister of Health Matthews reportedly stated "There is no evidence, whatsoever, that there is an issue related to turbines." [4] This statement is scientifically incorrect.

July 2011 Environmental Review Tribunal (ERT) Decision, Ontario

As noted above, the CanWEA sponsored Colby et al. (2009) literature review stated "Sound from wind turbines does not pose a risk of hearing loss or any other adverse health effect in humans." [5] Three of the co-authors of this statement, Drs. Colby, Leventhall, and McCunney testified on behalf of the Respondents (Ministry of Environment, Suncor Energy Services Inc.) during an Ontarian Environmental Review Tribunal (ERT).

Evidence provided at the ERT demonstrated the above statement authored by the CanWEA sponsored panel experts is incorrect.

The July 2011 ERT decision for an IWT project in Ontario [6] confirmed IWTs can harm humans:

> "While the Appellants were not successful in their appeals, the Tribunal notes that their involvement and that of the Respondents, has served to advance the state of the debate about wind turbines and human health. This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. *The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree.*" (p. 207) (*Emphasis added*)

Evidence and testimony provided to the ERT by witnesses called by the Appellants served to advance understanding of IWT induced health impacts. It is now acknowledged that IWTs do pose a risk of adverse health effect in humans if they are improperly sited.

All ten of the witnesses called upon by the Appellants were qualified as expert witnesses. The expert witnesses called upon by the Appellants have been involved in original

research on the health effects of IWTs and/or have had related articles accepted in peer reviewed scientific journals.

During the ERT expert witnesses for both the Respondents and the Appellants provided evidence and/or testimony which acknowledged IWTs sound is perceived to be more annoying than transportation noise or industrial noise at comparable sound pressure levels.

Peer reviewed articles and other references acknowledge annoyance to be an adverse health effect. (Pedersen & Persson Waye, 2007 [3]; Michaud et al. 2005 [4]; Health Canada, 2005 [5]; Suter, 1991 [6])

During the ERT expert witnesses for both the Respondents [11, 12, 13, 14, 15, 16] and the Appellants provided evidence and/or testimony which acknowledge annoyance to be a health effect.

Research confirms for chronically strong annoyance a causal cham exists between the three steps health–strong annoyance–increased morbidity [15] and must be classified as a serious health risk. [16]

During the ERT expert witnesses for both the Respondents and the Appellants provided evidence and/or testimony which acknowledged IWTs "will" cause annoyance, which can result in stress related health impacts including sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic episodes associated with sensations of internal pulsation or quivering when awake or asleep, and depression.

During the ERT witnesses for both the Respondents and/or the Appellants provided evidence and/or testimony which indicate plausible causes of these health effects include: IWT amplitude modulation, audible low frequency sound, infrasound, tonality, lack of nighttime abatement, shadow flicker, visual impact, economic impacts or a combination thereof.

It is acknowledged Ontario regulations and/or noise guidelines will not protect all individuals from these health impacts. A 2010 final draft report prepared for the Ontario Ministry of Environment (MOE) states:

> "The audible sound from wind turbines, at the levels experienced at typical receptor distances in Ontario, *is nonetheless expected to result in a non-trivial percentage of persons being highly annoyed*. As with sounds from many sources, research has shown that annoyance associated with *sound from wind turbines can be expected to contribute to stress related health impacts in some persons*." [17] (*Emphasis added*)

> *of science and technology, scientists and engineers involved with the study and policy-making of their own craft, and the concerned general leader. A third category of readers represents "society": all journalists dealing with the impacts of science and technology in their respected fields, the public interest groups and the attentive public.*" [32]

One article presents the result of WindVOiCe, an Ontario self reporting health survey that follows the principles of Health Canada for vigilance monitoring of pharmaceuticals and other products. [33]

Another article documents social justice impacts when people cannot obtain mitigation or resolution and in some cases, have abandoned their homes due to IWT exposure. [34]

An article authored by Dr. Bob Thorne documents his research on IWT noise and correlates this with reported IWT adverse health impacts. Based this field work Dr. Thorne concludes a sound level of LAeq 32 dB outside the residence is required to avoid serious harm to human health. [35]

Ontario MOE documents obtained from a Freedom of Information request support a 32 dBA sound limit for IWTs. Based on real world field investigations MOE field officers advised the Ministry about IWT adverse effects and stated "… the setback distances should be calculated using a sound level limit of 30 to 32 dBA at the receptor, instead of the 40 dBA sound level limit." [36]

Dr. Robert McMurtry, former Dean of Medicine, University of Western Ontario, and 2011 recipient of Member of Order of Canada, published a case definition to facilitate a clinical diagnosis regarding adverse health effects and IWTs. [37]

Other articles explore topics including how to properly interpret IWT epidemiological evidence, [38] the physics of IWT noise, [39] public health ethics, [40] potential IWT noise impacts on children, [41] and potential IWT infrasound sound impacts on the human ear. [42]

These articles are critical to anyone interested in the safe siting of IWTs. It is recommended that authorities and regulators obtain a copy of each of the nine articles.

Please use this link if you wish to access these articles http://bst.sagepub.com

Downloads of these articles can be obtained with an individual subscription for $100. This will allow you to download these and other articles from the BSTS scientific journal.

MOE documents obtained through a Freedom of Information request confirm current Ontario IWT guidelines will cause adverse effects. One 2010 MOE internal memorandum states:

> "It appears compliance with the minimum setbacks and the noise study approach currently being used to approve the siting of WTGs will result or likely result in adverse effects contrary to subsection 14(1) of the EPA" [18]

Another MOE reference documents Ontario families that have abandoned their homes due to sleep disturbance caused by exposure to wind turns. [19] Sleep disturbance is an adverse health effect. MOE correspondence also documents families that have moved out of their homes and have made financial settlements with the respective IWT developer. [20]

Based on original research in Ontario, and elsewhere, a peer reviewed article states:

> "It is acknowledged that IWTs, if not sited properly, can adversely affect the health of exposed individuals. In addition to physiological and psychological symptoms there are individuals reporting adverse impacts, including reduced well-being, degraded living conditions, and adverse societal and economic impacts. These adverse impacts culminate in expressions of a loss of fairness and social justice.
>
> The above impacts represent a serious degradation of health in accordance with commonly accepted definitions of health as defined by the WHO and the Ottawa Charter for Health Promotion." [21]

August 2011 peer reviewed articles published in a scientific journal

Subsequent to the July Ontario ERT decision nine peer reviewed articles have been published in a special August, 2011 edition of the scientific journal, *Bulletin of Science, Technology and Society* (*BSTS*). These articles explore health and social impacts of IWT installations. [22, 23, 24, 25, 26, 27, 28, 29, 30]

The Special Edition is entitled *Windfarms, Communities and Ecosystems*. Included in the special edition, is a commentary by the editor, Willem H. Vanderburg. [31]

The SAGE website states:

> *"The goal of the* ***Bulletin of Science, Technology and Society*** *is to provide a means of communication within as wide of a spectrum of the STS community as possible. This includes faculty and students from sciences, engineering, the humanities, and social science in the newly emerging groups on university and college campuses, and in the high school systems, all of which teach integrative STS subject matters. It also includes professionals in government, industry and universities, ranging from philosophers and historians of science to social scientists concerned with the effects*

IWT low frequency noise and infrasound

In the past some commentators have stated low frequency noise from IWTs is not an issue. Other references indicate most available evidence suggests that reported IWT health effects, such as sleeplessness and headache, are related to audible low frequency noise. [43]

A June 2011 Federal Australian Senate committee investigating IWT and adverse health effects report recommended:

> "… noise standards adopted by the states and territories for the planning and operation of rural wind farms should include appropriate measures to calculate the impact of low frequency noise and vibrations indoors at impacted dwellings."[44]

A June 2011 peer reviewed article on IWT low frequency noise is available. [45]

The abstract states:

> As wind turbines get larger, worries have emerged that the turbine noise would move down in frequency and that the low-frequency noise would cause annoyance for the neighbors. The noise emission from 48 wind turbines with nominal electric power up to 3.6 MW is analyzed and discussed. The relative amount of low-frequency noise is higher for large turbines (2.3–3.6 MW) than for small turbines ([1] 2 MW), and the difference is statistically significant. The difference can also be expressed as a downward shift of the spectrum of approximately one-third of an octave. A further shift of similar size is suggested for future turbines in the 10-MW range. Due to the air absorption, the higher low-frequency content becomes even more pronounced, when sound pressure levels in relevant neighbor distances are considered. Even when A-weighted levels are considered, a substantial part of the noise is at low frequencies, and for several of the investigated large turbines, the one-third-octave band with the highest level is at or below 250 Hz. It is thus beyond any doubt that the low-frequency part of the spectrum plays an important role in the noise at the neighbors."

Annoyance from audible low frequency noise is acknowledged to be more severe in general. Low frequency noise does not need to be considered loud for it to cause annoyance and irritation. [46] Low frequency noise causes immense suffering to those who are unfortunate to be sensitive to it [47] and chronic psychophysiological damage may result from long-term exposure to low-level low frequency noise. [48] Some symptoms associated with exposure to low frequency noise include annoyance, stress, sleep disturbance, headaches, difficulty concentrating, irritability, fatigue, dizziness or vertigo, tinnitus, anxiety, heart ailments and palpitation. [49, 50, 51]

Møller and Pedersen, (2011) indicate IWT low frequency noise is more of an issue for large turbines of 2.3 MW and up. [52] However low frequency noise from smaller turbines (ie 1.5MW) can also cause adverse health effects. Freedom of Information documents

obtained from the MOE document low frequency noise issues from smaller IWTs (i.e., 1.5 MW) at Ontario wind farms. The MOE documents how IWT low frequency noise caused a home to be "uninhabitable" resulting in family members abandoning trying to sleep there. [53] For further discussion see Krogh (2011) [54] and Thorne (2011). [55]

Research on the potential impacts of IWT infrasound has been published in two peer reviewed scientific journals (Salt and Hullar, 2010 [56]; Salt and Kaltenbach, 2011 [57]). These articles conclude that it is scientifically possible that infrasound from IWTs could affect people living nearby and more research is needed.

Wind Turbines Noise, Fourth International Meeting

During the Rome Conference Fourth International Meeting on Wind Turbine Noise Rome Italy 12-14 April 2011 there were a number of presentations documenting IWT noise issues.

The Wind Turbine Noise (2011) post-conference report states:

> "The main effect of daytime wind turbine noise is annoyance. The night time effect is sleep disturbance. These may lead to stress related illness in some people. Work is required in understanding why low levels of wind turbine noise may produce affects which are greater than might be expected from their levels." [58]

A number of conference papers addressed human health impacts of IWTs. For example one research team conducted a study which demonstrated those living in the immediate vicinity of IWTs scored worse than a matched control group in terms of physical and environmental health related quality of life (HRQOL). [59]

The Ontario ERT expert witnesses for both the Respondents and the Appellants provided evidence and/or testimony which acknowledged IWT amplitude modulation and/or audible low frequency noise are probable causes of IWT adverse health effects.

Research related to low frequency noise "…confirms the importance of fluctuations as a contributor to annoyance and the limitation of those assessment methods, which do not include fluctuations in the assessment." [60]

In addition, the World Health Organization states:

> "Noise measures based solely on LAeq values do not adequately characterize most noise environments and do not adequately assess the health impacts of noise on human well-being. It is also important to measure the maximum noise level and the number of noise events when deriving guideline values. If the noise includes a large proportion of low-frequency components, values even lower than the guideline values will be needed, because low-frequency components in noise may increase the adverse

effects considerably. When prominent low-frequency components are present, measures based on A-weighting are inappropriate." [61]

Consultants for the Ontario MOE, Aercoustics, submitted a paper at the Fourth International Meeting on Wind Turbine Noise which states:

> "Sound emissions from operating wind farms frequently give rise to noise complaints. Most compliance-based noise audits measure hourly "A"-weighted Leq, thereby removing the low-frequency contents of the wind turbine sound. The metric is also insensitive to amplitude modulation and is unsatisfactory when sensitive receptor are annoyed by the low frequency sound and amplitude modulation." [62]

Current Ontario guidelines are based on the A-Weighted Leq metric and hence must be considered unsatisfactory to protect individuals from the health impacts of IWT amplitude modulation and/or low frequency noise.

The need for research

The authors of a Canadian Wind Energy Association sponsored report state they do not "advocate for funding further studies." [63]

The April 2011 Wind Turbine Noise post-conference report states:

> "Work is required in understanding why low levels of wind turbine noise may produce affects which are greater than might be expected from their levels." [64]

A June 2011 Australian Senate committee investigating IWT and adverse health effects report recommended:

> "… the Commonwealth Government initiate as a matter of priority thorough, adequately resourced epidemiological and laboratory studies of the possible effects of wind farms on human health. This research must engage across industry and community, and include an advisory process representing the range of interests and concerns." [65]

The July 2011 Ontario ERT decision also acknowledged that more research is needed. [66]

> "Just because the Appellants have not succeeded in their appeals, that is no excuse to close the book on further research. On the contrary, further research should help resolve some of the significant questions that the Appellants have raised." (p. 207)

International experts who have conducted original research and/or published peer reviewed articles in scientific journals confirm that research is required. [67] [68] [69] [70] [71] [72] [73] [74] [75] [76]

Inappropriate use of literature reviews

Literature reviews can be useful tools for summarizing existing literature related to a particular topic. In order to be considered reliable a literature review must be complete, accurate, and objective.

In recent years a number of literature reviews have been produced which purport to explore the health effect of IWTs. Some literature reviews which have been relied upon to deny IWTs can adversely affect the health of humans. These literature reviews include Chatham-Kent Public Health Unit. (2008), [77] Colby et al. (2009), [78] Ontario Chief Medical Officer of Health. (2010), [79] and the National Health and Medical Research Council (Australia) (2010). [80] None of these literature reviews have been published in a peer reviewed scientific journal.

Reliance on these literature reviews is inappropriate as they contain errors of omission and/or commission and are neither convincing nor authoritative. Many of the conclusions are incomplete, inaccurate, lack objectivity and consequently only serve to confuse the issue of IWT health effects.

For example, these literature reviews limit their discussion to direct effects using qualifiers such as "direct physiopathological effects" or "direct causal links". Failure to carefully evaluate the indirect causal pathways and the psychological harm of IWT exposure represent errors of omission. Annoyance, sleep disturbance, cognitive and emotional response, and stress are health effects that occur through the indirect pathway. [81] The health outcomes associated with the indirect pathway are significant:

> "Physiological experiments on humans have shown that noise of a moderate level acts via an indirect pathway and has health outcomes similar to those caused by high noise exposures on the direct pathway. The indirect pathway starts with noise-induced disturbances of activities such as communication or sleep." [82]

The Ontario Environmental Review Tribunal expressed concern that the Director for the MOE relied on references which did not address the indirect pathway. [83]

As a consequence of their weaknesses some literature reviews have been criticized for their poor quality.

In March 2011, the Chief Executive Officer of National Health and Medical Research Council stated regarding their July 2010 literature review:

> "We regard this as a work in progress. We certainly do not believe that this question has been settled. That is why we are keeping it under constant review. That is why we said in our review that we believe authorities must take a precautionary approach to this." [84]

Chatham-Kent Public Health Unit (2008), [85] Colby et al, December 2009, [86] Ontario Chief Medical Officer of Health (2010), [87] share many of the same weaknesses as National Health and Medical Research Council (2010). [88] These literature reviews cannot be relied for Renewable Energy Applications and/or Renewable Energy Approvals to support the contention there is no evidence that IWTs can cause adverse health effects. For detailed analysis of some of these literature reviews visit www.windvigilance.com

Conclusion

Based on the best available evidence the following conclusions can be made

1. The Canadian Wind Energy Association sponsored statements that IWTs do not pose a risk of adverse health effects in humans are scientifically incorrect.
2. Experts who have conducted original research and/or published peer reviewed articles in scientific journals confirm IWTs can harm human health if they not sited properly.
3. Acknowledged adverse health effects include: annoyance, stress, sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory; and panic episodes associated with sensations of internal pulsation or quivering when awake or asleep. Other adverse impacts include reduced well-being, degraded living conditions, and adverse societal and economic impacts. These adverse impacts culminate in expressions of a loss of fairness and social justice.
4. The above impacts in conclusion 3 represent a serious degradation of health in accordance with commonly accepted definitions of health as defined by the WHO and the Ottawa Charter for Health Promotion.
5. It is expected that at typical setbacks and with the noise study approach currently being used in Ontario to approve the siting of IWTs, a non trivial percentage of exposed individuals will experience serious degradation of health.

6. Harm to human health can be avoided with science based regulations based on research conducted on human response to IWT exposure.

7. Experts who have conducted original research and/or published peer reviewed articles in scientific journals confirm that research is required to establish scientifically based IWT regulations to protect human health.

8. Until scientifically based research has been conducted IWTs should not sited in proximity to human habitation.

Respectfully submitted,

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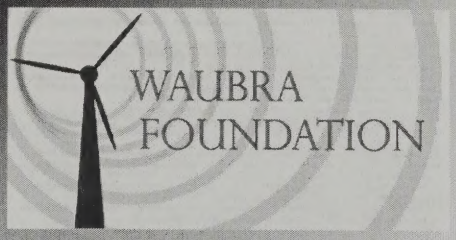
Summary of Recent Field Observations of Adverse Health Effects from Wind Developments in Australia,

and

Update from NH&MRC workshop and Australian Senate Inquiry

Dr Sarah Laurie BMBS
Medical Director, Waubra Foundation
Presentation 14th June, 2011
Cape Cod



www.waubrafoundation.com.au

What is the Waubra Foundation?

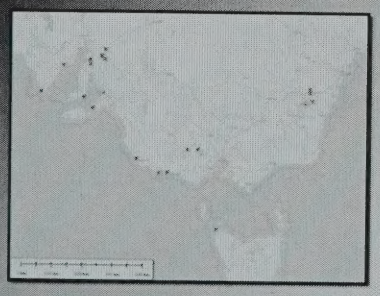
- **Advocacy body** to facilitate independent research into adverse health effects
- **Collect field observations** & then approach independent researchers
- **National Organisation**, links to key acoustic, scientific and medical researchers globally
- **Do not take a pro or anti wind position** – solely concerned with Adverse Health Effects

Location of Wind Developments

Recent Field Observations

- Ongoing data collection from multiple Wind Developments across SE Australia
- Includes information from following sources:
  - interviews with affected residents
  - medical records
  - treating physicians
  - personal health journals
  - acoustic monitoring inside homes

LOCATION OF WIND DEVELOPMENTS In South Eastern Australia



Personal Health Journal Information

date	time	Blood Pressure	Heart rate	Symptoms	Weather conditions	Wind Dir'n	Wind Spee	Turbines turning

Summary of Key Findings

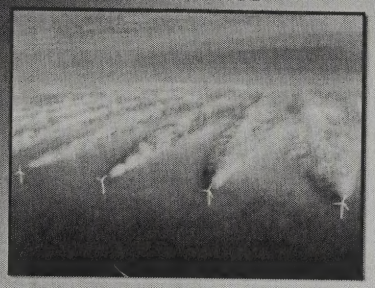
- Over 60 people interviewed so far
- Includes local residents, workers and visitors
- Symptoms characteristic of exposure to wind turbines (never previously experienced) noted up to 10km away
  - Night time waking in panicked state
  - Body vibrations
- Symptoms ALWAYS worsen with increasing exposure over time

Summary of Key Findings cont.

- Consistent with previous findings of Medical practitioners such as
  - Dr Amanda Harry (UK Rural Family Physician)
  - Dr David Iser (Australian Rural Family Physician)
  - Dr Nina Pierpont (US Paediatrician)
  - Dr Robert McMurtry in the Society for Wind Vigilance community health survey
- Many symptoms were known to, and reported by Acousticians such as Dr Leventhall, prior to 2004, in situations of known infrasound & low frequency noise (ILFN) exposure

Report for DEFRA by Dr G Leventhall, Dr P Pelmear & Dr S Benton May 2003
"A review of Published Research on Low Frequency noise and its Effects"

Distance Effect of Wake Turbulence



Summary of Key findings cont.

- Symptoms start to resolve when
  - Turbines are off (especially if more than 24 hours)
  - People move away from turbines

  BUT
- People "sensitized" with prolonged exposure then notice symptoms with other sources of ILFN
  - § Pumps
  - § Heating & Cooling compressors/ventilation systems

Health Problems Identified

- **Preexisting medical conditions which worsen with wind turbine exposure**
  - Hypertension (high blood pressure)
  - Angina
  - Diabetes
  - Tinnitus
  - Migraines

Health Problems Identified cont.

- **Severe Frequent Headaches**
  - Head "in a vice"
  - Children with no previous history of headaches
  - Migraines triggered, especially from shadow flicker
- **Visual Blurring**
  - Only occurring with turbine operation
  - Visual checks by health practitioners normal

Health Problems Identified cont.

- **Severe Chronic Sleep Deprivation** (multiple causes which include)
  - Audible turbine noise
  - Waking in a panicked state, wide awake, sometimes on multiple occasions every night
  - Increased nocturnal urination
  - Children's sleep problems
  - Bed vibrating

Health Problems identified cont.

- **Tinnitus** (ringing or buzzing, one or both ears)
- **Ear pressure** sensations (painful at times, especially if previous eardrum surgery)
- **Hyperacusis** (extreme sensitivity to 'normal' sounds)
- **Balance disturbance** (especially in elderly)
- **Motion sickness/vertigo** like symptoms
- **Nausea** (severe)

Health Problems Identified cont.

- **Irritability, extreme anger** and other mood disturbances (also being reported in workers)
- **Memory & Cognitive deficits** (worsening over time)
- **Depression**, at times life threatening
- **Anxiety**
- **Body vibrations**
- **Tachycardias & arrhythmias** (fast & irregular heartbeats)

Clinical Evidence for Sympathetic Nervous system stimulation

- ILFN Induced Sympathetic nervous system stimulation, via Vestibular stimulation or direct stimulation of the brain, is experienced ACUTELY by the person affected as:
  - Tachycardia (fast heart beat)
  - Elevated blood pressure including acute hypertensive episodes
  - Tako Tsubo heart attack episodes
  - Nighttime waking in a panicked state
  - Acutely anxious feelings
  - Unmasking of previous PTSD symptoms (but either well controlled or in abeyance at time of initial exposure to wind turbines)

Additional Clinical Observations

- Reports emerging of two specific clinical illnesses known to be **caused by surges of adrenaline** occurring with exposure to wind turbines (and other sources of ILFN)
  - **Tako Tsubo** heart attacks
  - **Acute Hypertensive Crises**
- Limited animal studies confirm infrasound exposure can result in adrenaline surges
  (NIEHS Toxicology of Infrasound report 2001)

Additional Clinical Observations cont

- Observations of new onset hypertension (high blood pressure) with turbine operation
- Multiple causative mechanisms likely, probably concurrent
  - § Infrasound (experimental studies have shown this effect, via direct or indirect (vestibular) stimulation of sympathetic nervous system 'fight – flight')
  - § Stress
  - § Sleep Deprivation

Qibai and Shi (2007) The Effects of Low Frequency Noise and Vibration on People (ed Prof C. Hansen) *An Investigation on the Physiological and Psychological Effects of Infrasound on Persons* 303-310

Predictors of Onset & Severity

Predictors of **Rapid Onset of Severe Symptoms** of Wind turbine Syndrome (WTS) appear to be

a)**Living downwind of a line of turbines** (cumulative impact)

a)**Presence of ground borne (seismic) vibrations**

- § Beds vibrating
- § Glass of water vibrating

Other reports of residential overnight exposure to ILFN

- **Overnight exposure to ILFN** seems particularly **damaging to health**
- Others who have developed similar health problems including Tako Tsubo Heart attacks, sleep deprivation and high blood pressure which start to partially resolve when exposure ceases
  - **Residents in suburban Melbourne** next to industrial chillers at Melbourne University
  - **Residents 5km away from open cut coal mining** activities active at night (diesel machinery)

Cumulative Impact

Links to Vibro Acoustic Disease

- Substantial body of work by Professor Mariana Alves Pereira & Dr Nuno Castelo Branco over 30 years in Portugal
- Serious health concerns (VAD) with chronic exposure to ILFN (variety of sources)
- Based on their recent work, **levels of measured ILFN inside homes near wind developments will result in VAD in residents**

Tissue Pathology observed in VAD

- **Thickened collagen**, resulting in
  - Decreased lumen of blood vessels (arteries)
  - Thickening of exterior lining of the heart (pericardium)
- **Malignant tumours** in the sole autopsy case
  - (patients with WTS have been noted to have elevated cortisol which will certainly decrease the body's own immunity and ability of the immune system to eradicate abnormal cells over time)

The relationship between WTS & VAD

- I think Dr Pierpont is right, in stating as she did in Ontario that maybe we should call WTS "ILFN syndrome"
- Acousticians for years have been calling these symptoms "annoyance" without Medical Clinicians realising that there are serious health problems emerging with acute and chronic exposure (with a few notable exceptions such as Dr Harry, Dr Iser, Dr Pierpont & Dr Castelo Branco)

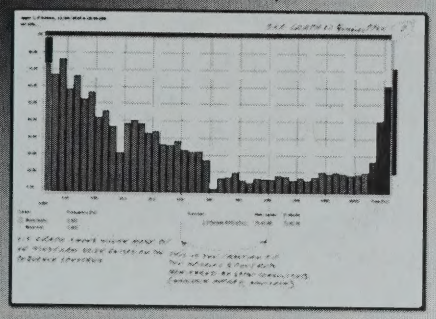
Tissue Pathology observed in VAD

- Professor Alves Pereira also described collagen pathology found in horses on the farm in Portugal, using a case control design
  - Ie collagen changes are "cross species", adding further weight to the evidence of a biological causal effect of ILFN on tissue with chronic exposure

The relationship between WTS & VAD

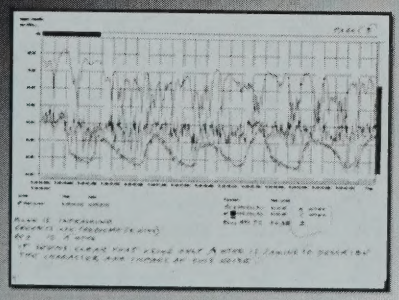
- My conclusions
  - There are multiple pathophysiological mechanisms causing the pathology we are seeing
  - **There is a difference between the effects and therefore the symptoms of acute exposure (WTS) and chronic exposure (VAD)**
  - There may be a synergistic effect eg angina
    - Acute effect – adrenaline surge leading to vasoconstriction
    - Chronic effect – collagen thickening producing structurally narrowed diameter of blood vessel
    - BOTH PATHOLOGIES ACTING TOGETHER WILL RESULT IN DECREASED BLOOD FLOW TO THE HEART MUSCLE

Acoustics Field Data from inside Noel Dean's bedroom, Waubra



Outcome - Home Abandonment

Acoustics Field Data from Inside Noel Dean's bedroom at Waubra



Waubra Foundation Strategies

- **Empower** affected residents with information
- **Educate** treating Medical Practitioners
- **Publicise** the problems via the media & community information sessions
- **Data Collection** (local residents leading the way with personal health journals)
- **Liase** with Researchers **globally**
- **Liase** with Politicians and Bureaucrats **locally**

Mechanisms for harm to health

- **KNOWN** – audible noise
- **HIGHLY LIKELY** – Infrasound & low frequency noise
  - § Airborne pulsations
  - § Resonance within dwellings
  - § Seismic (ground borne) vibrations
- **POSSIBLE** – Electromagnetic radiation effects
- **OTHER?**

Research Questions

1. What is a 'safe' setback distance?

1. What are the mechanisms of causation?

What we know already

1. **Chronic severe sleep deprivation and high blood pressure are very damaging to health** (extensive peer reviewed research)
2. **Both are being identified as new health problems** in residents adjacent to wind developments after commencement of turbine operation
3. **Both are measureable**

These need to be investigated and quantified

Waubra Foundation Research Priorities

- **Concurrent audible noise & ILFN monitoring inside** people's homes with symptom reports, and
  - §sleep studies,
  - §blood pressure studies (24 hour ambulatory blood pressure)
  - §Biochemical indices (cortisol)

Data collection from Residents up to 10km away from turbines

Waubra Foundation Research Priorities

- **Replication** of Dr Michael Nissenbaum's recent study of Sleep, Depression & Quality of Life
- **Case control study** - effect on children's sleep, learning & cognition

Waubra Foundation Research Priorities

- **Monitoring of Worker's Health**
  - Partnership with key Occupational Health and Safety Stakeholder
  - Development of prospective audit program
- **Retrospective analysis** of case reports of Tako Tsubo heart attacks from medical records
- **Prospective collection of clinical and biochemical data** from Tako Tsubo episodes and acute hypertensive crises from multiple sites
- **EMF measurement**

Waubra Foundation Research Priorities

- **Epidemiological studies** to investigate
  - range of medical and psychiatric health problems being experienced, and
  - Analysis of their severity
- **Prospective case control study** of residents adjacent to two small wind developments (2-3 turbines) in Victoria

Update – NH&MRC workshop 7th June, 2011 Canberra

- Variously described as a "Workshop" and a "Scientific Forum"
- Battleground is probably a more accurate descriptor!
- First time affected residents, health bureaucrats, academics, advocacy groups and wind developers were together
- Panel of speakers represented various points of view, followed by small group workshops

Update, NH&MRC workshop cont.

- The two speakers who presented clear evidence of serious health problems resulting from wind turbines (Professor Alves Pereira & Dr Bob Thorne) were
  - Clear & concise
  - Evidence based
  - talked about their own empirical research

Update – Australian Senate Inquiry report tabled 14th June, 2011

- Tabling of report delayed yet again – now due Wednesday 22nd June
- Senator Fielding (instigator of inquiry) leaves Parliament on 30th June
- Widespread suspicions of politicisation of inquiry outcome
  - § Green Senator is Chair of committee
  - § 2 Labor Senators
  - § 1 Liberal Senator (Senator Judith Adams)
  - § 1 Family First (Senator Steve Fielding)

Update, NH&MRC workshop cont

- In contrast, the other two presenters had **no primary research in this area of their own**, and **misrepresented research of others** which they did talk about, in order support their "case"
- Conclusion from most attendees at the forum (with the exception of some developers) is that
  - There is further independent research required
  - Those asserting "there is no problem" are on increasingly shaky ground

Update – Australian Senate Inquiry report tabled 14th June, 2011 cont.

Individuals and groups supportive of wind development who **agreed there was a need to address the health concerns** in their oral or written testimony included

- CFMEU (construction union sub no 638)
- Clean Energy Council CEO Mr Matthew Warren p31, Melbourne Hansard transcript
- Mr Simon Holmes a Court (sub no 628, and p62 Melbourne Hansard transcript)
- Professor Simon Chapman, p118 Melbourne Hansard transcript
- Mr Lane Crockett, Pacific Hydro, p 76 Melbourne Hansard
- Mr Cam Walker, Friends of the Earth, p 118 Melbourne Hansard

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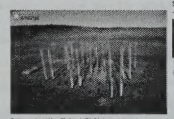
Science News

Bold New Approach to Wind 'Farm' Design May Provide Efficiency Gains

ScienceDaily (July 13, 2011) — Conventional wisdom suggests that because wind approaching the theoretical limit on individual wind turbine efficiency, wind energy is now a mature technology. But California Institute of Technology researchers revealed some of the fundamental assumptions that guided the wind industry for the past 30 years, and now believe that a new approach to wind farm design -- one that places wind turbines closer together instead of far apart -- may provide significant efficiency gains.



Research at the Caltech Field Laboratory for Optimized Wind Energy, directed by John Dabiri, suggests that groups of densely packed vertical axis wind turbines can actually generate more power than conventional wind farms with propeller-style turbines. (Credit: John Dabiri, Caltech)

This challenger the notion of thought that the only remaining advances in turbine size is downsizing larger turbines, putting them offshore, and relying for government policies favorable to the further penetration of wind power in energy markets.

What has been overlooked, he adds is that, for wind-harvesting the mechanical advances in wind turbine tech design, wind farms are still rather inefficient when taken as a whole," explains John Dabiri, professor of Engineering and Applied Science, and director of the Center for Bio-Inspired Engineering at Caltech. "Because conventional propeller-style wind turbines must be spaced far apart to avoid interfering with one another aerodynamically, much of the wind energy that enters a wind farm is never tapped. In effect, modern wind farms are like skyscrapers of activity where the climate cells they're built better and target for optimal 'trade winds.'

But this oversight in neighborhood size leads to frequently cited issues such as: an inefficient use and efficiency of engineering and maintaining the larger structures, aforementioned, and wider signatures problems, as well as more bat and bird impacts.

Dabiri is focusing on a more efficient form of wind farm design, navigating individual wind turbine efficiency to the hope next. He describes this new design in the American Institute of Physics' Journal of Renewable & Sustainable Energy.

"The available wind energy at 10 feet is much less abundant than that found at the height of modern wind turbines, but it never ground and can be harnessed more efficiently there's no need to access the higher altitude winds," he says. "In global wind power available at 10 feet exceeds global electricity usage several times over. The challenge? Capturing that power."

The Caltech design focuses that power by relying on vertical-axis wind turbines (VAWTs) in arrangements that place the turbines much closer together than is possible with horizontal-axis propeller-style turbines.

VAWTs provide several potentially benefits, according to Dabiri, including efficient operation in turbulent winds that does not jump to the ground. A design and gearbox or yaw drive that can lower costs all considered and maintenance, and a lower profile that reduces environmental impacts.

See Also:

Matter & Energy
- Solar Energy
- Construction
- Energy Policy

Earth & Climate
- Renewable Energy
- Energy and the Environment
- Environmental Science

Reference
- Machine
- Biomass
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Journal Reference:

1. John O. Dabiri. Potential order-of-magnitude enhancement of wind farm power density via counter-rotating vertical-axis wind turbine arrays. Journal of Renewable and Sustainable Energy, 2011; 3 (4): 043104 DOI: 10.1063/1.3608170

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MLA: "Bold new approach to wind 'farm' design may provide efficiency gains." ScienceDaily. ScienceDaily, 13 Jul. 2011. Web. 21 Jul. 2011. <http://www.sciencedaily.com/releases/2011/07/110713131644.htm>.
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PROJECT REPORT

TO: PLANNING COMMISSION AGENDA DATE August 11, 2010

FROM: Planning & Development Services Dept. AGENDA TIME 9:00AM/No. 4

PROJECT TYPE: Coyote Wells (FEIR) SUPERVISOR DIST # 2

LOCATION: Ocotillo/Nomirage area APN: 033-623-003 [illegible] PARCEL SIZE: 943.75 Acres

GENERAL PLAN (existing) Ocotillo-Nomirage Desert Reserve GENERAL PLAN (proposed) Coyote Wells SP

ZONE (existing) S-1 / 1-40 ZONE (proposed) Coyote Wells Specific Plan

GENERAL PLAN FINDINGS ☒ CONSISTENT ☐ INCONSISTENT ☐ MAY BE/FINDINGS

PLANNING COMMISSION DECISION: HEARING DATE: 08/11/2010

☐ APPROVED ☐ DENIED ☐ OTHER

PLANNING DIRECTOR'S DECISION: HEARING DATE:

☐ APPROVED ☐ DENIED ☐ OTHER

ENVIRONMENTAL EVALUATION COMMITTEE DECISION: HEARING DATE:

☐ NEGATIVE DECLARATION ☐ MITIGATED NEG. DECLARATION ☒ EIR

DEPARTMENTAL REPORTS / APPROVALS:

PUBLIC WORKS	☐ NONE	☒ ATTACHED
AG / APCD	☐ NONE	☒ ATTACHED
E.H.S.	☐ NONE	☒ ATTACHED
FIRE / OES	☐ NONE	☒ ATTACHED
OTHER	See attached	

REQUESTED ACTION:

IT IS RECOMMENDED THAT YOU CONDUCT A PUBLIC HEARING, THAT YOU HEAR ALL THE OPPONENTS AND PROPONENTS OF THE PROPOSED PROJECT. STAFF WOULD THEN RECOMMEND THAT YOU TAKE THE FOLLOWING ACTION:

1. RECOMMEND TO THE BOARD OF SUPERVISORS TO CERTIFY THE EIR FOR THE Coyote Wells SPECIFIC PLAN, ANY COMMENTS RECEIVED, HAS BEEN COMPLETED PURSUANT TO GOVERNMENT CODE SECTION 15125, ET. SEQ. AND THE COUNTY'S "RULES AND REGULATIONS TO IMPLEMENT CEQA AS AMENDED" AND THAT THE SIGNIFICANT EFFECTS CONTAINED THEREIN HAVE BEEN REVIEWED AND CONSIDERED IN THE DECISION ON THE PROJECT.

2. RECOMMEND TO BOARD OF SUPERVISORS MAKE THE FINDING THAT THE PROPOSED PROJECT WILL NOT INDIVIDUALLY OR CUMULATIVELY HAVE AN ADVERSE EFFECT ON FISH AND WILDLIFE RESOURCES, AS DEFINED IN SECTION 711.2 OF THE FISH AND GAME CODES, OTHER THAN THE REQUIRED MITIGATION MEASURES IDENTIFIED HEREIN.

3. RECOMMEND THE BOARD OF SUPERVISORS MAKE THE FINDING OF FACT, AND ADAPT THE MITIGATION/MONITORING AND REPORTING PROGRAM (MMRP).

4. Make the attached Findings of FACT.

4. RECOMMEND TO THE BOARD OF SUPERVISORS, THE APPROVAL OF the FINAL ENVIRONMENTAL IMPACT REPORT.

PLANNING/DEVELOPMENT SERVICES DEPT., 90 MAIN ST., EL CENTRO, CA., 92243 (760) 482-4236 LAURO HEUBERGER, ASSIST. DIRECTOR/S:\APN FILES\033\FEIR\033XXPC package\PC 08 11 10\proj\proj\chapters\PROJREPPC FEIR housing.doc

The Coyote Wells Specific Plan

Wind Zero Group, Inc. owns 944 acres in the southwestern portion of Imperial County in the State of California. The Plan Area is situated within the Community of Ocotillo/Nomirage, south of Interstate 8 and largely north of State Route 98.

Wind Zero Group, Inc. has prepared and submitted the Coyote Wells Specific Plan and Gated Community Tentative Map to the County of Imperial for consideration and approval. Entitlements including General Plan Amendment, Zone Change, Gated Tentative Tract Map, Specific Plan and conditional use permits, are being sought to develop the property into a privately owned and state of the art law enforcement training facility and motorsports facility for driving enthusiasts. It is anticipated that full implementation of the Coyote Wells Specific Plan will occur in three (3) phases and span a total of nine (9) years. For planning and permitting purposes, Wind Zero Group, Inc. has developed projections for the total number of State Route 98 development users, law enforcement trainee participants, motorsports enthusiast participants and employees associated with the Coyote Wells Specific Plan Area. These projections appear in the sections dedicated to each defined area. The Coyote Wells Specific Plan Area will in large part function as a gated community with numerous amenities available to users. Access to the main portion of the Plan Area will be restricted to authorized visitors. Guard houses will be located at up to four (4) entry points to the main portion of the project area.

Purpose & Scope of Specific Plan

The purpose of the Coyote Wells Specific Plan is to designate permitted land uses within the project site, plan for phased construction of infrastructure improvements and specify development regulations and guidelines that will best provide for implementation of the Specific Plan's land use goals. Adoption of a specific plan is authorized by California Government Code (Title 7, Chapter 3, Article 8, Section 65450, et seq.).

Wind Zero Group, Inc. owns 944 acres in the southwestern portion of Imperial County, south of Interstate 8 and largely north of State Route 98 in the State of California. The project area is located within the USGS 7.5' Coyote Wells Quadrangle, Township 16 and 16 ½ South, Range 10 East, Sections 4, 5, 32 and 33. As the applicant of record, Wind Zero Group, Inc. has prepared the Coyote Wells Specific Plan and Gated Community Tentative Map to define the range of proposed activities within the Plan Area. The Coyote Wells Specific Plan aims to demonstrate consistency with the Ocotillo-Nomirage Community Area Plan. The Coyote Wells Specific Plan consists of twenty-two (22) proposed parcels and ten (10)proposed land use and zoning designations The Plan Area contains the following designations:

Overview of Coyote Wells Specific Plan Land Use and Zoning Designations		
Land Use and Zoning Designations	Total Acreage within Plan Area	% of Plan Area
Open Space Preservation	204.47	22%
Recreation	380.65	40%
Education & Training	220.11	23%
Tourism	16.51	2%
Residential – Townhomes	20.19	2%
Residential – RV	28.51	3%
Low Density Residential	6.26	<1%
Infrastructure Facilities	5.31	<1%
Light Storage	34.22	4%
Hotel Resort	7.93	<1%
Preschool	16.24	2%
Total	+/- 943.75	100%

The driving purpose of the Wind Zero Law Enforcement Training Facility is to meet the needs of local and regional law enforcement and public safety agencies. The intent is to extend training opportunities to agencies within California and across the United States. Approximately 220 acres or twenty-two percent (22%) of the Plan Area is dedicated to the Wind Zero Education and Training land use and zoning designation. The proposed facility will provide a safe environment in which participants can acquire the skills necessary in subjects that include:

- Law Enforcement training
- Firearms safety
- First responder training
- Inter-agency training
- Medical skills training
- Fire safety
- Driver education

The Wind Zero Law Enforcement Training Facility will allow for a range of activities, including curriculum delivered in classroom settings, mock urban settings to facilitate interagency training, and driver education and safety. The Wind Zero Law Enforcement Training Facility will operate year round and offer daytime and evening training opportunities. Wind Zero Group, Inc. proposes to develop a training facility that consists of the following components:

- Administration Building & Classrooms
- Emergency Vehicle Operations Center (EVOC)
- Skid Pad
- Paved Handling Area
- Burn and Rappel Tower
- Enclosed & Semi-Enclosed Shooting Ranges
- Live Fire Training Houses
- Helicopter Landing area
- Storage Facilities
- Three 2.0 Acre Residential Lots

It is anticipated that full implementation of the Coyote Wells Specific Plan, including the Wind Zero Law Enforcement Training Facility, the Coyote Wells Motorsports Facility and the State Route 98 Corridor, will occur in three (3) phases and span a total of nine (9) years.

Compatibility of Coyote Wells Specific Plan & Ocotillo/Nomirage Community Area Plan

Ocotillo/Nomirage Community Area

The Coyote Wells Specific Plan Area consists of the western portion of the Ocotillo/Nomirage Community Plan Area as identified in the County of Imperial General Plan (See Ocotillo/Nomirage Community Plan Area Map). According to the Imperial County General Plan,Community Areas are primarily intended for "second home, retirement or recreation areas with limited commercial or employment opportunities" (Land Use Element of the Imperial County General Plan: October 17, 2006, p.5). The Ocotillo/Nomirage Community Area Plan was adopted by the Imperial County Board of Supervisors on April 26, 1994. The purpose of the Community Plan "is to identify the goals, policies and standards that will guide future growth," State of California Government Code § 65454 states that a specific plan may not be adopted unless the proposed plan is consistent with the general plan. This section of the Coyote Wells Specific Plan demonstrates the compatibility of the Coyote Wells Specific Plan with the Ocotillo/Nomirage Community Area Plan.

Towns & Communities

Goal To preserve and enhance the distinct character of the Ocotillo/Nomirage Community Area.

Project Conformance

The activities associated with the Coyote Wells Specific Plan will strengthen the character of the community, as well as its visibility and importance within the County of Imperial and State of California.☐ The Coyote Wells Specific Plan will enhance the distinctive community identity of Ocotillo/Nomirage by providing development guidelines that define attractive and desert appropriate architecture and landscaping. Improvements associated with the Plan Area will significantly stabilize soil conditions, improving visibility along Interstate 8 and reducing associated hazards. The Coyote Wells Specific Plan ensures the appropriate preservation of known culturally significant resources within the Plan Area.

Economic Growth

Goal To provide employment opportunities in the Ocotillo/Nomirage Community Area to serve the needs of area residents while preserving the unique character of the area.

Project Conformance

The Coyote Wells Motorsports Facility comprises a large portion of the Coyote Wells Specific Plan Area. Nearly forty percent (40%) of the Plan Area is dedicated to the Coyote Wells Recreation zoning and land use designation. Its focus is to create the first professionally designed road track in California with a focus on the motorsports enthusiast.

The Coyote Wells Motorsports Facility is structured as a luxury membership based organization, similar to a golf country club. Track memberships will offer a number of benefits, including member-only driving days and premium use of facilities. Premium use of facilities will ensure priority accommodations for onsite car storage and participation in exclusive training events.

The driving track (paved surfaces ONLY, – no off-roading) will be available for rental. Users will include international driving clubs such as Porsche, Ferrari and BMW. Typically, driving clubs will rent a circuit for two full weekend days and arrange for the preceding Friday to be made available to members that wish to come early for extra driving time and equipment tuning.

The Coyote Wells Motorsports Facility will be available to the public and local driving enthusiasts through a variety of driver training and education courses.

The Coyote Wells Motorsports Facility is comprised of several components:

- Administration Building
- Three (3) Circuit 6.1 Mile Paved Road Track
- Truck Control Tower and Medical Building
- Clubhouse, Restaurant & Conference Center
- Go Karting Track
- Airstrip (extension of existing Preston Airstrip)
- Aircraft Hangars
- Pit Area
- Retail Sales Building
- Classroom Building
- Office Building
- Maintenance Building
- Thirty Two (32) Trackside Townhomes
- Twenty Eight (28) Garage Lofts
- One Hundred (100) Room Hotel Resort
- Fueling Services
- One Hundred Fifty Eight (158) Auto Storage Garages
- Dry RV Park

The Coyote Wells Specific Plan Area will offer amenities to the surrounding area with development appropriate for the State Route 98 corridor. Proposed uses along the State Route 98 Corridor include:

- Gas & Convenience Store
- Restaurant

COUNTY OF IMPERIAL
COYOTE WELLS SPECIFIC PLAN
FINAL ENVIRONMENTAL IMPACT REPORT

SCH No. 2009011063

Prepared for:

COUNTY OF IMPERIAL
801 MAIN STREET
EL CENTRO, CA 92243

Prepared by:

PMC
6020 CORNERSTONE COURT WEST, SUITE 350
SAN DIEGO, CA 92121

JULY 2010

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ivpressonline.com

Wind Zero given green light

By ELIZABETH VARIN

Imperial Valley Press Staff

1:01 AM PST, December 22, 2010

A vote on a controversial law enforcement training facility was a long time coming, Brandon Webb of Wind Zero said.
The chief executive officer of the project said regardless of how the Imperial County Board of Supervisors voted, it was good to get a decision on the project slated for near Ocotillo after months of discussion and years of work.
It was even better to get the green light, he said.
The supervisors voted 4-1 in favor of the project, citing job creation as a reason to push it forward. Supervisor Jack Terrazas voted against the project.
"Every time opportunity stares us in the face, there are individuals opposed to economic growth for their own personal reasons," Supervisor Michael Kelley said. "But for those of us who have an interest in the economic future of Imperial County, we must go forward."
Wind Zero, set for a 944-acre site south of Interstate 8 and mostly north of Highway 98, would include two race tracks, indoor and semi-enclosed shooting ranges, a live-fire training house, indoor virtual training environments and meal and lodging on site. It would be completed in three phases over a nine-year period.
Kelley said it was progress for the area, as it will save thousands of dollars for law enforcement agencies by making training available nearby. It will also have a financial benefit for the Ocotillo area.
Some residents didn't feel that way, as they came to the meeting with signs and speeches. A few people in the meeting tried to push for more public comment, but Chairman Louis Fuentes made it clear multiple times that the public comment period ended Dec. 13.
After the meeting, Susan Massey with the group People Against Wind Zero said that the decision was a disappointment, adding it will have a big impact on residents and the community as a whole.
There is still a chance the project won't go through as people were talking after the meeting about possible litigation. Those against the project have 30 days to file a lawsuit.
There were concerns that the board didn't seem to take into consideration, Massey said. The only source of water in the area is ground water, and the project could drain the supply.
Terrazas, who voted against the project, said he still had concerns over water and the type of community in the area.
"When does it become a gamble?" he asked. "And how much do we gamble to draw jobs to the area?"
There are good parts of the project, but the board can't pick and choose what it wants in the area, he said. It's the whole project or nothing.
Applause came from about half of the audience at the meeting anytime a point against the project came up. Even afterward, a negative shout went through the County Administration Center toward Webb.
It's not the first time someone's yelled at him, Webb said. However, he's confident the project is in the best interest of the area.
It's more than just jobs, he said. The project fits in the overall county community.
"This is a law enforcement area," he said. "We have the Naval Air Facility, Customs and Border Protection, fire and police."
Staff Writer Elizabeth Varin can be reached at evarin@ivpressonline.com or 760-337-3441.

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City Lights News

Suit Filed to Halt Wind Zero's Proposed Military Training Facility Near Ocotillo

By Dorian Hargrove | Published Wednesday, Jan. 26, 2011

Change doesn't come often to the desert community of Nomirage, located 13 miles east of San Diego County and 2 miles southeast of Ocotillo's quiet town center.

But change is what will happen when Brandon Webb, the 36-year-old former Navy Seal and chief executive officer of San Diego firm Wind Zero, breaks ground on a law-enforcement and military-training facility 30 feet from Nomirage's eastern border.

The 944-acre facility will have indoor firing ranges and semi-enclosed ranges, including one 300-meter range and mock-up urban environments with street layouts and ten live-fire training houses. According to the project's environmental impact report, after all three phases of the project are complete, an estimated 57,000 bullets will be fired on a typical day.

In addition, the facility will offer two helicopter landing pads, an airstrip, three road courses — two for training law enforcement and military personnel and the third a 6.1-mile racetrack for car enthusiasts — a three-story burm and rappel tower, a hotel, a restaurant, and private living quarters.

Yet for the 90 residents living west of Mohtar Road, the dirt road that marks the border between Nomirage and Wind Zero, the facility is an attack on their way of life and a potential threat to their water supply.

Critics claim the project is identical to a controversial proposal by Blackwater (now renamed Xe Services) to build an 824-acre training facility in Potrero. That proposal was contested by local residents and environmental groups. The company retreated after it was found that noise levels from gunfire would exceed county standards.

Retreat is what residents of Nomirage would like to see from Wind Zero. Anger over Wind Zero's proposal intensified in June 2007 when Brian Bonfiglio, Blackwater's vice president, showed up at a presentation that Wind Zero chief executive Webb was giving at a community meeting.

"There's been a lot of negativity about this Blackwater issue," Webb says during a January 17 phone interview. "There's this big conspiracy that we're a shadow company for Blackwater, but it's ridiculous. [Bonfiglio] showed up at the meeting, and I didn't even know until afterwards. If we were associated, then the worst thing I could do would be to bring a member of Blackwater to a community meeting."

Jim Sierawski, spokesperson for United Training Services, a division of Xe Services, denies that Xe has any involvement in Wind Zero's proposed training facility.

While there is no evidence of a link between the firms, Webb admits that there are similarities between his project and Blackwater's, such as the shooting ranges and road courses. "Blackwater started right about the same time we did," says Webb. "I get why people think there are similarities because there are. But when you look at the plans, there are major differences."

One important difference is the location. While the site of Blackwater's proposed facility was near the Mexican border in southeast San Diego County, Wind Zero's site is outside Ocotillo, where fewer residents live.

But the residents of Nomirage believe that Wind Zero's project will destroy their quiet desert lifestyle.

Nomirage sits between Interstate 8 and Highway 98, seven miles east of the mountains. Approximately 50 homes on one-acre lots make up the community. Creosote bushes dot the landscape. Roads are unpaved and bumpy. The large lots make the houses look small and provide room for mobile homes and old RVs. Nearly every property has at least one rusty shed.

Violet Steele's house lies on the community's eastern boundary. Her backyard faces the open land now owned by Wind Zero. On a January afternoon, over the faint sound of traffic from I-8, she and three other women, all retired and over 60, have gathered at Steele's home to discuss the impacts that Wind Zero's project will have on their lives.

"Who wants to live next to shooting ranges and heliports and racetracks?" asks Ginny Chandlee, whose property also borders Molitar Road. "It's not reasonable. My husband and I used to walk outside and listen to the quiet. He passed away two years ago, and I'm sure that he's rolling over in his ashes."

"This is all we have," says Barbara Hill. "Our houses will be worth nothing. We have no place to go."

The women jump from one objection to another, all of which focus on three issues: noise, traffic, and water.

"They say we won't hear guns firing," says Steele. "How could they say that? Fifty-seven thousand bullets? We hear everything out here. That's one of the reasons we moved here was because of the quiet."

In addition to the sounds of gunfire, another worry is the traffic the facility will bring. The environmental impact report estimates that the project will generate 4391 trips during the week and 5266 on weekends.

Edie Harmon's biggest concern is water.

According to the environmental impact report, two new potable water wells located on Wind Zero's site will pump 144,000 gallons per day from the Coyote Wells Valley Groundwater Basin. The basin, designated by the United States Geological Survey as a sole-source aquifer, provides the only source of domestic water in the area. Harmon, who lives in Ocotillo, says the water level in the basin is dropping.

"Each lot in this area has to have its own well," says Harmon. "You can pump a small quantity of water from many different places, but if you try to pump a lot from one location, it will take the water from other wells and contaminate the rest."

Harmon says the lower the water levels get the more saline the water becomes. If the water becomes too saline it will be nonpotable.

"The supposed expert hired by [Webb] to prepare the environmental impact report did not include the most recent United States Geological Survey water study," says Harmon. "They relied on a faulty study from 2004."

Harmon accuses Imperial County's Planning Department staff and its board of supervisors, who approved the project at their December 21 meeting, of ignoring data in order to generate property- and sales-tax revenues.

"The county wants to believe that there is plenty of water for the development it wants," she says. "But when this water is gone, it's gone, and there is no potential for recharging the basin. Without it, this area is uninhabitable."

Webb first came up with the idea to build the training facility in 2006, after years of conducting sniper training for the Navy. The Point Loma resident, who recently coauthored his first book, *The 21st-Century Sniper: A Complete Practical Guide*, says that after the Naval Training Center in Point Loma closed, the Navy began sending sailors to the East Coast for training.

"I found that there was an opportunity to put everything that [law enforcement and the military] need to train all on one location. I wanted the desert," says Webb. "I wanted a place that could offer year-round training."

Webb found desert land for sale adjacent to Nomirage. "To the north of the property is Interstate 8, to the south is Highway 98, and the east is owned by Bureau of Land Management. To the west you have that little section of Nomirage. To be honest, I don't consider it a sprawling residential community." The Wind Zero property has "a highway on one side and an interstate on the other side. That's why I chose the land," Webb says.

He presented his plan to the Imperial County Planning Department in late 2006. "I told them our plans, and they said that they didn't see any problem with it."

Webb says that his company has mitigated concerns about noise by moving the indoor and semi-enclosed shooting ranges one-half mile away from Nomirage. And Wind Zero has agreed to contribute to road improvements along Highway 98, which would minimize traffic impacts to the community.

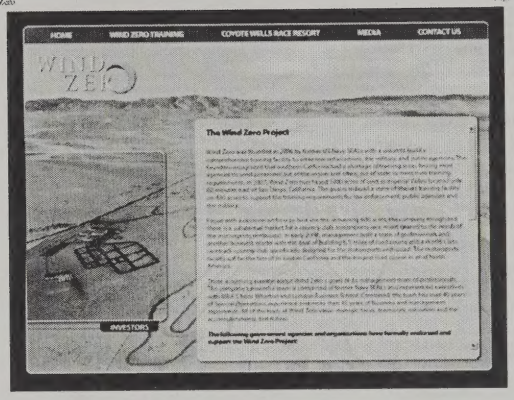
"After meeting with residents, we've made a lot of changes. We are going to develop an environmentally responsible project," he says.

Webb is looking for additional funding to develop the site. He predicts construction crews will break ground in early 2012.

During that time, Edie Harmon will continue to look for flaws in the environmental impact report in order to defeat the project. And others such as Ginny Chandlee will live in fear that they might have to move away.

"I will leave if I want to keep my sanity," Chandlee says. "I didn't move here for that. I thought I'd cried my last tears, I guess I haven't."

On Tuesday, the Sierra Club and Desert Protection Council filed suit against Wind Zero, Imperial County, and the Imperial County Board of Supervisors. Citing violations of state environmental law, the suit asks the court to direct Imperial County to set aside its approval of the Wind Zero project.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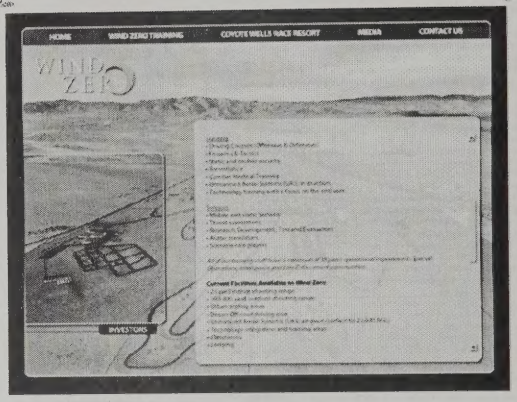
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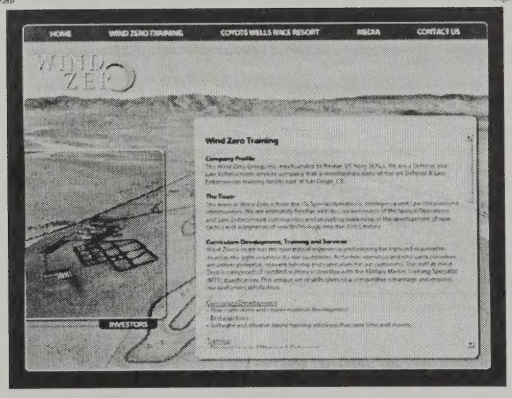
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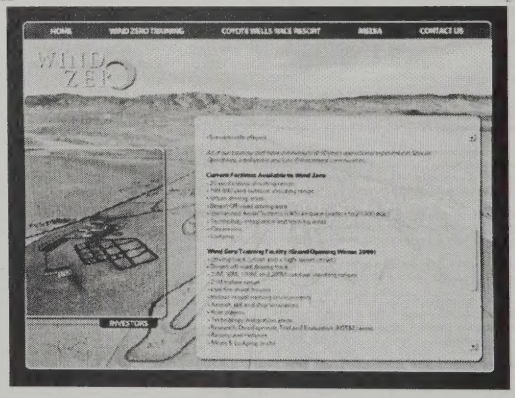
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Valley fever on the rise in California7:05 PM, February 12, 2009

http://latimesblogs.latimes.com/booster_shots/2009/02/valley-fever-on.html

Reported cases of valley fever--a flu-like illness caused by inhaling airborne spores of a dirt-dwelling fungus -- more than tripled in California from 2000 to 2006, and scientists don't know why.

From 2000 to 2006, the number of California cases rose from 816, or 2.4 cases per 100,000 people, to 2,981, or 8 per 100,000, according to a study by the California Department of Public Health in today's Morbidity and Mortality Weekly Report, a publication of the national Centers for Disease Control and Prevention.

Most illnesses occurred in the San Joaquin Valley, especially Kern County, which averaged 150 cases per 100,000 people. African Americans and Filipinos were most likely to develop rare but serious complications.

The study put forth a number of theories about why infections are rising. The increase could have to do with housing and other construction that disturbs soil and sends the spores flying. It could have to do with an increase in the number of people with chronic conditions that weaken their immune systems. (People with HIV are particularly susceptible to coccidioidomycosis, the official name for valley fever.) It could have to do with new people who have never been exposed to the fungi moving into places where it is plentiful.

About 60% of those infected never show symptoms. The rest develop a flu-like illness with cough, headache, muscle aches and fatigue that can last a month. About 1% develop a more severe illness that affects the brain, skin and other organs. People of African and Filipino descent may be more susceptible to this for hereditary reasons.

The illness is treatable with oral or injected anti-fungal medications, which is why the state and the CDC are alerting physicians to be alert to these symptoms in people who live or have traveled in areas where the fungi are found.

Two related types of fungi can cause the illness: *Coccidioides immitis* and *Coccidioides posadasii*. Besides the San Joaquin Valley, they can be found in parts of Arizona, Utah, Nevada, New Mexico, west Texas, Mexico and Central and South America.

California still trails Arizona, which reports the most cases of valley fever every year and has also seen an increase, from 1,812 cases (37 per 100,000) in 1999 to 5,535 cases (91 per 100,000) in 2006.

--Mary Engel

Photo credit: Mark Boster/Los Angeles Times

Last fall, heeding advice from local health officials and a federal receiver charged with improving the state's prison medical care, the Department of Corrections and Rehabilitation delayed plans to add 600 new beds out of concern that the construction might stir up more spores.

Officials at the prison blame the construction of a state hospital nearby for causing a spike in valley fever. The construction was under way from 2001 to 2005, and valley fever hit its peak here in 2006, when the disease was diagnosed in 514 inmates.

This year, about 300 cases have been diagnosed among inmates at the prison, which sits along a highway lined with almond groves and signs advertising new "semi-custom homes." Felix Igbinosa, the prison's medical director, said "the No. 1 reason" was thought to be the soil disturbance from new construction.

The delayed expansion here was part of a $7.9 billion plan signed by Gov. Arnold Schwarzenegger last summer to relieve overcrowding in the state's prisons. Pleasant Valley was built in 1994 to house 2,000 inmates.

California reported more than 3,000 cases of valley fever in 2006, the most in a decade. Explanations for the spike have included increased residential development and changes in weather patterns that have resulted in increased blooms of the fungus.

Other prisons in the Central Valley of California have had increases in the number of fever cases in recent years, but in none has the rate of infection been higher than at Pleasant Valley, where about one inmate in 10 tested positive in 2006.

Even allowing for the nearby construction, experts say they do not know why the disease is so rampant here.

"Is the soil surrounding Pleasant Valley different?" asked Dr. Demosthenes Pappagianis of the University of California, Davis.

"There's a lot we still need to know about it," said Dr. Pappagianis, a professor of medical microbiology and immunology who has been studying valley fever for more than 50 years.

Early symptoms of the disease, which is clinically known as coccidioidomycosis, mimic the flu, with symptoms that include a cough, lethargy and a fever. Most of those who become infected recover with little or no treatment and are subsequently immune.

In about 2 percent to 3 percent of the cases, the disease spreads from the lungs and can attack the bones, liver, spleen and skin.

For the 11,000 non-inmate residents of Coalinga, about 200 miles southeast of San Francisco, the disease has been a fact of life for generations. "We just deal," said Trish Hill, the city's mayor. "You don't do stupid things like go out on windy days or dig in the dirt."

Inmates appear to be especially susceptible to the disease, in part because they come from areas all over the state and have not developed an immunity to the disease. California corrections officials are preparing new guidelines for prison design, including ventilation and landscaping.

"Prisons tend to have a lot of bare dirt, and that has some security benefit," said Deborah Hysen, the corrections department's deputy secretary of facility planning. "But in the case of valley fever, you want to really contain the soil."

At Pleasant Valley, officials say the outbreak of valley fever places a burden on the institution, requiring guards to escort inmates to local hospitals, where stays can last months and result in medical and security costs of $1 million and more, said Dr. Igbinosa, the medical director.

NEW YORK TIMES

December 30, 2007

Fever spores are found in soil around Pleasant Valley State Prison in Central California. They can be inhaled when the soil is moved.

Infection Hits a California Prison Hard
By JESSE McKINLEY

COALINGA, Calif. — When any of the 5,300 inmates at Pleasant Valley State Prison begin coughing and running a fever, doctors do not think flu, bronchitis or even the common cold.

Gilbert Galaviz, contracted valley fever shortly after beginning his sentence at Pleasant Valley State Prison.

They think valley fever; and, more often than they would like, they are right.

In the past three years, more than 900 inmates at the prison have contracted the fever, a fungal infection that has been both widespread and lethal.

At least a dozen inmates here in Central California have died from the disease, which is on the rise in other Western states, including Arizona, where the health department declared an epidemic after more than 5,500 cases were reported in 2006, including 33 deaths.

Plaintiffs' trials in facilities at Pleasant Valley
Prisons are declared out of compliance with federal standards
Judge lifts up valley fever centers

Endemic to parts of the Southwest, valley fever has been reported in recent years in a widening belt from South Texas to Northern California. The disease has infected archaeologists digging at the Dinosaur National Monument in Utah and dogs that have inhaled the spores while sniffing for illegal drugs along the Mexican border.

In most cases, the infection starts in the lungs and is usually handled by the body without permanent damage. But serious complications can arise, including meningitis; and, at Pleasant Valley, the scope of the outbreak has left some inmates permanently disabled, confined to wheelchairs and interned in expensive long-term hospital stays.

About 80 prison employees have also contracted the fever, Pleasant Valley officials say, including a corrections officer who died of the disease in 2005.

What makes the disease all the more troubling is that its cause is literally underfoot: the spores that cause the infection reside in the region's soil. When that soil is disturbed, something that happens regularly where houses are being built, crops are being sown and a steady wind churns, those spores are inhaled. The spores can also be kicked up by Mother Nature including earthquakes and dust storms.

"It doesn't matter whether you're custody staff, it doesn't matter if you're a plumber or an electrician," said James A. Yates, the warden at Pleasant Valley. "You breathe the same air as you walk around out there."

The epidemic at the prison has led to a clash of priorities for a correctional system that is dealing with below average medical care and chronic overcrowding.

The disease also affects inmate morale, doctors say.

Gilbert Galaviz was convicted of murder and is serving a sentence of 25 years to life. Mr. Galaviz had been at Pleasant Valley for a week or so when he started to feel sick. "I couldn't breathe," he said. "My chest starting hurting. I had pain all over like somebody beat me up, and I would sweat bad at night."

The cause was valley fever. After six months, Mr. Galaviz is still weak, having lost 30 pounds, and is barely able to complete a lap in the prison yard. Earlier this month, he was attacked and his jaw broken.

"It wouldn't have been like that if it hadn't been for valley fever," Mr. Galaviz said, his jaw still wired shut. "They wouldn't have got me. It would have been the other way around."

Dan Barry is off. Beginning Jan. 14, the "This Land" column will appear on Mondays.

EMERGING INFECTIOUS DISEASES
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Research

Coccidioidomycosis among Workers at an Archeological Site, Northeastern Utah

Lyle R. Petersen* (/eid/article/10/4/03-0446_article.htm#comment), **Stacie L. Marshall***, **Christine Barton†**, **Rana A. Hajjeh†**, **Mark D. Lindsley‡**, **David W. Warnock‡**, **Anil A. Panackal‡**, **Joseph B. Shaffer§**, **Maryam B. Haddad‡‡**, **Frederick S. Fisher¶**, **David T. Dennis***, **and Juliette Morgan‡**

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Main Article (/eid/article/10/4/03-0446_article.htm)

Figure 1

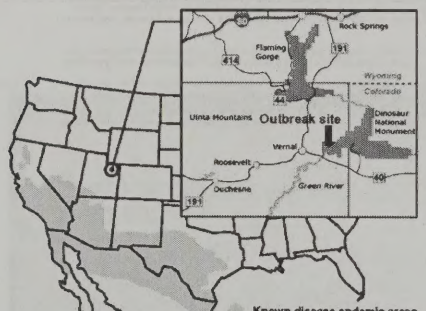

Figure 1. Known geographic distribution of *Coccidioides immitis* in the United States and location of the 2001 coccidioidomycosis outbreak in Utah. Source: U.S. Geological Survey, Operational Guidelines for Geological Fieldwork in Areas Endemic for Coccidioidomycosis (Valley fever), 2000.

Main Article (/eid/article/10/4/03-0446_article.htm)

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Coccidioidomycosis among Workers at an Archeological Site, Northeastern Utah

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In 2001, an outbreak of acute respiratory disease occurred among persons working at a Native American archeological site at Dinosaur National Monument in northeastern Utah. Epidemiologic and environmental investigations were undertaken to determine the cause of the outbreak. A clinical case was defined by the presence of at least two of the following symptoms: self-reported fever, shortness of breath, or cough. Ten workers met the clinical case definition; 9 had serologic confirmation of coccidioidomycosis, and 8 were hospitalized. All 10 were present during sifting of dirt through screens on June 19; symptoms began 9–12 days later (median 10). Coccidioidomycosis also developed in a worker at the site in September 2001. A serosurvey among 40 other Dinosaur National Monument workers did not find serologic evidence of recent infection. This outbreak documents a new endemic focus of coccidioidomycosis, which extends northward its known geographic distribution in Utah by approximately 200 miles.

Coccidioidomycosis results from inhaling spores (arthroconidia) of *Coccidioides immitis*, a soil-dwelling fungus endemic to the southwestern United States and parts of Mexico, Central America, and South America. The organism is recovered from soil in areas with yearly annual rainfall averaging 5–20 inches, hot summers, infrequent winter freezes, and alkaline soil (1). Although up to 160,000 new infections may occur annually (2), reported point source outbreaks are infrequent and have followed diverse soil-disrupting activities or events, such as archeological or anthropological digs (3–5), military maneuvers (6), play involving throwing dirt (7), construction work (8), earthquakes (9), dust storms (10,11), model airplane flying competitions (12), and armadillo hunting (13).

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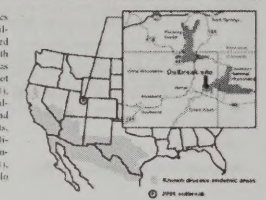
We report a point-source outbreak of coccidioidomycosis among workers who participated in soil-disrupting activities at an archeological site in Dinosaur National Monument in northeastern Utah during June and July 2001. This site was approximately 200 miles north of previously known *C. immitis*–endemic areas for in Utah (Figure 1). In addition, we report results of a serologic survey of Dinosaur National Monument employees performed to assess recent exposure to *C. immitis*.

Outbreak Setting

Dinosaur National Monument covers 320 square miles in the Uinta Basin in northeastern Utah and northwestern Colorado (Figure 1). A total of 197,800 visitors were recorded in 2000. During summer 2001, 49 permanent and 49 seasonal employees, as well as approximately 126 volunteers, worked at the monument. A weather station,



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located approximately 0.5 miles from the outbreak site, has recorded an average annual precipitation of 8.7 inches since 1958.

The outbreak site, at an elevation of 4,825 feet in an arid, treeless region with small hills and rock outcroppings, is under a rock overhang. The overhang faces directly south and receives reflected heat from the surrounding fri able sandstone. Heat trapped within the shelter raises the temperature several degrees above the outside temperature, hence its name, Swelter Shelter (14). Swelter Shelter's soil is a fine-grained, sandy loam containing approximately 10% clay, 10% silt, and 80% fine sand. The soil has a low water-holding capacity, an organic matter content of <5%, a pH of 8.5 to 11.0, and salinity of 8 to 16 mmhos/cm (15). Swelter Shelter is on the main automobile tour through Dinosaur National Monument and is accessed by a short trail.

Archeological excavations conducted at Swelter Shelter in 1964 and 1965 were part of a larger archeological survey of the monument that included many Native American sites (14). The inside wall of Swelter Shelter contains Native American petroglyphs and pictographs dating from the Fremont Culture before 1200 A.D. The 1964 and 1965 excavations identified artifacts as old as 7000 to 6000 B.C., as well as two ancient fireplace hearths, one of which contained burned animal bones (14). Unknown to those working in 2001, an outbreak of respiratory illness had occurred among those conducting the earlier archeological excavations (16).

On June 18, 2001, under the direction of National Park Service archeologists, a team of six student volunteers and two volunteer leaders began work at Swelter Shelter. Work included laying stone steps, building a retaining wall, and sifting dirt for artifacts—an activity that created considerable dust. Within the week before work began, the volunteers and leaders had arrived from their residences throughout the United States; one arrived from Europe. While at the monument, they camped in tents approximately 3 miles away from Swelter Shelter. During June 29 to July 3, all six volunteers, both leaders, and two National Park Service archeologists who worked at the site sought medical care in a local hospital emergency room for acute respiratory and systemic symptoms.

Methods

Case Definitions

Persons working at Dinosaur National Monument were defined as meeting the clinical case definition for coccidioidomycosis if they had onset after June 18, 2001, of at least two of the following symptoms: self-reported fever, difficulty breathing, and cough. Persons meeting the clinical case definition were considered to have had laboratory-confirmed coccidioidomycosis if a complement fixation (CF) antibody titer of ≥1:2 was present or if either of the immunodiffusion tests showed a band of identity. Further confirmation of infection was obtained if there was seroconversion or a ≥4-fold rise in antibody titer between paired serum samples.

Cohort Study

From July 2 to 4, 2001, 38 people (all six student volunteers, both volunteer leaders, and all 10 National Park Service archeologists at Dinosaur National Monument) were interviewed by using a standardized questionnaire to determine symptoms and activities from June 18 to 29. In addition, clinical information was gathered from emergency room and hospital records of persons who sought medical care and recorded on another standardized form. Differences in categorical variables were assessed with the Fisher exact test.

Laboratory Studies

Acute-phase serum samples were obtained on July 1 or July 3 from persons meeting the clinical case definition and were tested for antibodies to *Francisella tularensis*, *Yersinia pestis*, *Mycoplasma* species, *Histoplasma capsulatum*, and *C. immitis* by using standard techniques at laboratories at the Centers for Disease Control and Prevention. In addition, all persons had serologic tests for *Rickettsia rickettsii*, five for *Legionella*, and five for hantavirus at local laboratories. Blood cultures for bacterial pathogens were obtained during hospitalization.

Convalescent-phase serum samples were obtained from July 16 to 21, 2001. Acute- and convalescent-phase serum samples were assayed for antibodies to *C. immitis* by CF and immunodiffusion (IDCF), primarily to detect immunoglobulin (Ig) G antibodies. Acute-phase serum samples were assayed by immunodiffusion (IDTP) primarily to detect IgM antibodies (IDTP) (17); the IDTP assay was further performed with serum concentrated three- to fivefold.

Environmental Investigation

Monthly average temperature and precipitation data for the Dinosaur National Monument quarry area (approximately 0.5 miles from Swelter Shelter) for 1958 to 2002 were obtained from the Western Regional Climate Center (available from: www.wrcc.dri.edu/cgi-bin/cliMONtavt.pl?utdino and www.wrcc.dri.edu/cgi-bin/cliMONtpre.pl?utdino). Daily rainfall data were obtained from weather station records at the monument.

Serologic Survey of Monument Workers

From August 15 to 17, 2001, we conducted a serologic survey among Dinosaur National Monument employees to

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determine the presence of antibodies to *C. immitis*. Because coccidioidomycosis skin test reagents are currently unavailable, testing for antibodies to coccidioidomycosis was performed to assess prior immunity to *C. immitis* among persons who reside or work in the area. Samples were tested using CF and IDCF as described earlier.

Results

Cohort Study

Ten of the 18 persons interviewed met the clinical case definition for coccidioidomycosis. The case-patients included all 6 volunteers, both group leaders, and 2 of 10 archeologists. The median age of patients was 17 years; five were male; and all were Caucasian. Illness onsets ranged from June 28 to July 1 (Figure 2).

Because the two group leaders and six volunteers traveled as a group and all became ill, the sites of possible exposure to coccidioidomycosis were limited to Swelter Shelter and their camping area, the only two places visited before June 27. All eight of these persons reported engaging in the same activities at each site; thus, determining specific risk factors at Swelter Shelter or the camping area was not possible. However, among the 10 archeologists, 2 of 3 who worked at Swelter Shelter in June met the clinical case definition compared to none of 7 who did not work there ($p = 0.07$). The two ill archeologists worked on June 19, when dirt near the petroglyphs was sifted with screens (archeologists A and B, Figure 2). The archeologist who remained healthy (archeologist C, Figure 2) only worked on June 20. On that day, sifting occurred along the trail approximately 15 feet from the petroglyph panel. Sifting did not occur on other days. Therefore, all persons meeting the clinical case definition, and none of the noncase-patients were present at the sifting on June 19 (Figure 2) ($p = 0.00002$). No archeologist had visited the camping area.

With June 19 being the most likely time of exposure, the median incubation period for the 10 persons who met the clinical case definition was 10 days (range 9–12). These persons reported difficulty breathing (10 persons), nonproductive cough (9 persons), fever (9 persons), fatigue (8 persons), shortness of breath (7 persons), myalgia (6 persons), skin rash (6 persons), and nausea/vomiting (4 persons). Eight persons were hospitalized, the one person who did not report fever had a temperature of 37.8°C on hospital admission. The mean temperature on admission was 38.3°C (range 36.9°C–39.4°C) and the average respiratory rate was 23 per minute (range 18–32). Results of a pulmonary examination were relatively unremarkable except for dry cough. At the time of evaluation, five patients had a maculopapular rash on the neck, trunk, and extremities. The mean leukocyte count at admission was 11,800 mm^3 (range 5,600–17,700), with an average of 80% neutrophils (range 67%–92%). Results of tests of liver and renal function, including urinalysis, were within normal limits. The average oxygen saturation was 93% (range 88%–97%) by pulse oximetry. Chest radiographs of all 10 case-patients showed bilateral patchy infiltrates. All persons hospitalized were treated with fluconazole and discharged within 3 days.

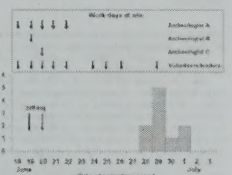

Figure 2. Number of persons meeting the clinical case definition, by date of symptom onset. Days worked at the site are indicated.

Acute-phase serum specimens from 9 of 10 persons who met the clinical case definition contained IgM antibodies to *C. immitis*, as determined by IDTP by using concentrated serum samples; one was positive by IDTP before serum concentration. The patient without demonstrable IgM antibodies on convalescent-phase serologic testing had pulmonary infiltrates and a skin rash typical of the other patients. Two of the eight patients with convalescent-phase samples had at least a fourfold increase in CF titer. Initial serologic tests for antibodies to *F. tularensis*, *Y. pestis*, *Mycoplasma* species, *R. rickettsii*, *Legionella*, and hantavirus were negative. Blood cultures were negative for bacterial pathogens.

Additional Case Investigation

On August 24, state and local health departments jointly recommended that employees minimize soil disturbance and dust inhalation (e.g., by watering down the soil and wearing National Institute for Occupational Safety and Health [NIOSH]–approved N95 respirators) at Swelter Shelter to reduce their risk for *C. immitis* infection. Five persons completed work on the retaining wall and steps on September 24 and 27, 2001. Although the soil was watered periodically during both days, the workers only wore masks on September 24. On October 5, 2001, left shoulder and chest pain, shortness of breath, fever, headache, diaphoresis, and shaking chills without skin rash developed in one worker. A chest radiograph on October 16

Why *C. immitis* can apparently persist at Swelter Shelter, an area well outside the known disease-endemic region, is not known. One possibility is that average soil temperatures within the shelter are higher than surrounding areas. Swelter Shelter is the only known Native American site at Dinosaur National Monument that faces south, is relatively sheltered, and receives considerable reflected heat from surrounding rock.

Attack rates during outbreaks at Native American sites outside of disease-endemic areas have been high. During the three California outbreaks, attack rates ranged from 48% to 77% (3–5), compared to 91% among those who worked at Swelter Shelter. At the shelter, sifting of dirt with screens appeared to place persons at a particularly high risk; the 91% attack rate in this outbreak probably reflects the fact that all of the workers participated in or close to the sifting.

We conclude that a newly identified endemic focus for *C. immitis* exists at a Native American archeological site in northeastern Utah. Archeologists working at Native American sites in the western United States are at risk for coccidioidomycosis, even outside recognized disease-endemic regions. Sifting of dirt during archeological activities may put persons at a particularly high risk for exposure to *C. immitis*. Measures to decrease dust and aerosolization of spores, such as soil wetting, and the use of appropriate masks while performing archeological work at these sites may reduce the risk. Archeological workers might benefit from vaccination; efforts are currently focused on developing a vaccine for coccidioidomycosis (24).

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indicated left lung pneumonia. Serum samples drawn on October 15 and November 7 demonstrated elevated and rising *C. immitis* IgG and IgM antibody levels by enzyme-linked immunosorbent assays at a commercial diagnostic laboratory, a finding consistent with acute coccidioidomycosis.

Environmental Investigation

Weather data indicated an unusually long dry period before the 2001 outbreak. No rain fell from May 3 to June 25. For May and June 1958 to 2002, the average temperatures were 14.9°C (standard deviation 1.4) and 20.1°C (standard deviation 1.6), respectively. The average temperatures in May and June 2001 were 17.1°C and 22.5°C. Since 1958, only 1 year (1994) had a warmer average temperature in both May and June.

Serologic Survey of Monument Workers

Forty employees were enrolled. Their mean age was 43 years; 26 (65%) were male. They had worked at Dinosaur National Monument for a median duration of 26 months (interquartile range 9–126 months) and had spent an average of 13.8 years living within 100 miles of the monument. Employee activities included digging up soil or rock (27.5%), sifting soil or dirt (7.5%), and preparing paths or trails (12.5%). A quarter (27.5%) reported work duties that exposed them to dust every day. Serologic tests for *C. immitis* antibodies were negative for all 40 persons.

Investigation of the 1964–1965 Archeological Team

To investigate the possibility that a similar outbreak occurred during the 1964–1965 archeological excavations at the monument, we interviewed by telephone the leaders of that 25-person, archeological team in January 2002. They identified five team members in whom acute respiratory illness occurred in 1964 to 1965. These five were contacted by telephone; all reported fever, dry cough, and chest pain with onsets toward the end of, or shortly after, the archeological activities. One was hospitalized for 10 days with pulmonary infiltrates; a skin rash and severe arthralgias also developed in this person. Three persons reported subsequent positive skin or serologic tests for *C. immitis*; none had previously lived in an area endemic for coccidioidomycosis. All five ill persons worked at Swelter Shelter in August 1964 or June and July 1965. None of those working at other sites had known illness.

Conclusion

This outbreak provides evidence of an endemic focus of coccidioidomycosis within Dinosaur National Monument in northeastern Utah, expanding the known geographic distribution of coccidioidomycosis. Multiple factors likely contributed to this outbreak: most patients lived in areas where coccidioidomycosis was not endemic and probably were without preexisting immunity to *C. immitis*; the alkalinity of the soil was favorable to the growth of *C. immitis*; a prolonged dry period occurred before the outbreak; and the archeological activities, particularly the sifting of the very fine-grained soil, caused considerable dust exposure.

Several lines of evidence indicate that the endemic focus at Swelter Shelter is highly localized and does not represent a larger unrecognized region of activity in northeastern Utah. First, the serologic survey failed to find recent serologic evidence of *C. immitis* exposure among other Dinosaur National Monument workers, although many reported frequent occupational exposure to soil or dust. However, the serologic survey could not rule out prior exposures since serologic test is insensitive for past infection (18). Second, locally acquired coccidioidomycosis has not been reported among other monument workers or in local residents. Third, although the cause of the 1964–1965 outbreak cannot be definitively determined, the illnesses were remarkably similar to those in 2001 and were only recognized in persons working at Swelter Shelter, despite extensive archeological activities at many other sites (14).

Consistent with the hypothesis of a highly focal endemic area at Swelter Shelter, a study of outdoor workers in California indicated that even in disease-endemic areas, highly focal areas of high risk for coccidioidomycosis exist and persist (19). Another study showed that after burial of animals that died of coccidioidomycosis in soil free of the organism, repeated isolations of *C. immitis* from the soil at the burial site were possible for at least 7 years, even though soil immediately surrounding the burial site remained uncontaminated (20).

The endemic focus at Swelter Shelter may have been established centuries ago. This outbreak and the three that occurred at Native American archeological sites in California outside the known range for *C. immitis* (3–5) suggest that these sites may represent a unique type of extremely focal endemic area. *C. immitis* is highly concentrated in Native American middens, indicating that the organism was highly prevalent among these people (21), and repeated isolations of *C. immitis* have been made at old Native American campsites in endemic areas (22). Analysis of the microsatellite loci of *C. immitis* to study the genetic diversity of the fungus has shown that isolates from North America are geographically partitioned. This finding suggests that *C. immitis* was spread throughout the Americas by migrating populations of Native Americans (23); the occurrence of outbreaks at Native American archeological sites outside known disease-endemic areas supports this hypothesis. The last identified Native American presence at Swelter Shelter dated before 1280 A.D. (14).

Enhanced Surveillance of Coccidioidomycosis, Arizona, USA, 2007–2008

Clarisse A. Tsang, Shoana M. Anderson, Sara B. Imholte, Laura M. Erhart, Sanny Chen, Benjamin J. Park, Cara Christ, Kenneth K. Komatsu, Tom Chiller, and Rebecca H. Sunenshine

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Learning Objectives

Upon completion of this activity, participants will be able to:

- Evaluate the impact of coccidioidomycosis on patients and the broader health system.
- Evaluate the performance of a laboratory-based system of diagnosis for coccidioidomycosis and incorporate that information into effective diagnostic strategies.

Editor

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Coccidioidomycosis is endemic to the southwestern United States; 60% of nationally reported cases occur in Arizona. Although the Council of State and Territorial Epidemiologists case definition for coccidioidomycosis requires laboratory and clinical criteria, Arizona uses only laboratory criteria. To validate this case definition and characterize the effects of coccidioidomycosis in Arizona, we interviewed every sixth case-patient with coccidioidomycosis reported during January 2007–February 2008. Of 493 patients interviewed, 44% visited the emergency department, and 41% were hospitalized. Symptoms lasted a median of 120 days. Persons aware of coccidioidomycosis before seeking healthcare were more likely to receive an earlier diagnosis than those unaware of the disease (p = 0.04) and to request testing for *Coccidioides* spp. (p = 0.05). These findings warrant greater public and provider education. Ninety-five percent of patients interviewed met the Council of State and Territorial Epidemiologists clinical case definition, validating the Arizona laboratory-based case definition for surveillance in a coccidioidomycosis-endemic area.

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Coccidioidomycosis, or valley fever, is a fungal disease endemic to the southwestern United States, parts of Mexico, and Central and South America. Infection probably occurs when arthroconidia from disrupted soil are inhaled, causing lung infection (*1*,*2*). Signs and symptoms occur 1–4 weeks after exposure and can include fever, cough, fatigue, shortness of breath, headache, joint and muscle aches, and rash. *Coccidioides* spp. can spread to the central nervous system, skin, joints, or bones in <1% of those infected, resulting in extrathoracic dissemination (*3*,*4*).

Each year, an estimated 150,000 persons in the United States become infected with *Coccidioides* spp., and >50,000 of those become ill (*5*). Most cases are not reported to health departments, resulting in an underestimated number of coccidioidomycosis cases (*6*). In 2006 in the United States, 8,947 coccidioidomycosis cases were reported, with 5,535 cases reported in Arizona (*7*). The number of reported coccidioidomycosis cases in Arizona began to increase in 1990. From 1990 through 1995, the annual number of reported coccidioidomycosis cases increased from 255 (7/100,000 population) to 623 (15/100,000 population) (*8*). This increase led the Arizona Department of Health Services (ADHS) to change its reporting rules to make coccidioidomycosis a laboratory-reportable illness in 1997.

Since laboratory reporting became mandatory, coccidioidomycosis case reports have rapidly increased in Arizona. In 2006, the number of cases peaked at 5,535 cases (84/100,000 population) and decreased in 4,815 cases (72/100,000 population) in 2007 and to 4,768 cases (71/100,000 population) in 2008. During 2006–2008 in Arizona, the median age of patients with coccidioidomycosis was 52 years (mean 51 years). Fifty-four percent of patients with coccidioidomycosis were male (84/100,000 population), and 46% were female (72/100,000 population).

The Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention require laboratory and clinical criteria to meet the case definition for coccidioidomycosis. The laboratory criteria consist of culture, histopathologic, or molecular evidence; or immunologic evidence in the form of detection of immunoglobulin M or immunoglobulin G by immunodiffusion, enzyme immunoassay, latex agglutination, tube precipitin, or complement fixation. Clinical criteria require infiltrative signs and symptoms; pneumonia or other pulmonary lesion; erythema nodosum or erythema multiforme rash; involvement of bones, joints, or skin by dissuppuration; meningitis; or involvement of viscera and lymph nodes (*9*).

Because of Arizona's large number of cases, ADHS uses only the laboratory component of the CSTE case definition. In 2007, ADHS initiated enhanced coccidioidomycosis surveillance (which included patient interviews) to validate a laboratory-exclusive case definition for coccidioidomycosis and to characterize the effects of the disease on Arizona's population, healthcare system, and economy. The purpose of this study was to validate this case definition and characterize the effects of coccidioidomycosis in Arizona during January 2007–February 2008.

Methods

Study Design

ADHS conducted a population-based investigation of coccidioidomycosis cases reported from January 2007 through February 2008 in Arizona. Every tenth patient with newly identified coccidioidomycosis reported through the statewide surveillance system was sent a letter informing them of the investigation, and all possible methods were used to collect telephone information for each patient. If telephone information was obtained, each selected patient was contacted by telephone and interviewed with the aid of a 15-minute standardized questionnaire. If the patient could not be reached after 3 attempts or refused to be interviewed, the subsequent case-patient was sent an enrollment letter and contacted for an interview. If a patient was <18 years of age, either the parent or guardian was interviewed or the patient was interviewed with a parent or guardian present. Interviewers were asked about the signs and symptoms of coccidioidomycosis they experienced, their healthcare-seeking behavior, their medical treatment information, and the effects of the disease on their daily lives. Interviewees self-reported their race as either white, African American, Asian or Pacific Islander, Native American or Alaska Native, or Other and their ethnicity as either Hispanic or non-Hispanic. Interviewees were asked whether they took any immunosuppressive drugs and were provided the following examples: chemotherapy medications, steroids, prednisone, dexamethasone, infliximab, and interferon. If a patient who spoke only Spanish was contacted, a Spanish-speaking interviewer called back to conduct the interview in Spanish.

Symptom information obtained from the interviews was used to determine whether the case-patients met the clinical portion of the CSTE case definition. Case-patients met the CSTE clinical case definition if they had ≥1 of the following: fever, cough, sore throat, chills, dyspnea, chest pain, hemoptysis, headache, rash, stiff neck, myalgias, or arthralgia.

Questions from the standardized questionnaire were added to the Arizona Behavioral Risk Factor Surveillance System (BRFSS). 2006, an annual population-based telephone survey about health behavior and opinions. Data from BRFSS in 2008 (n = 6,165) were used to represent the general population of Arizona and were compared with data from interviews with coccidioidomycosis patients to understand how the coccidioidomycosis patients' understanding differed from the BRFSS population's knowledge of coccidioidomycosis (*10*).

Data from the Arizona Hospital Discharge Database 2007 were used to examine charges for hospitalizations of patients with a primary or secondary diagnosis of coccidioidomycosis (*11*). Hospitalizations were identified by use of the International Classification of Diseases, 9th Revision for coccidioidomycosis (codes beginning with 114).

Data Management and Analysis

Data were entered into Microsoft Access (Microsoft Corp., Redmond, WA, USA) and analyzed by using SAS software (SAS Institute Inc., Cary, NC, USA). χ^2 tests were used to detect significant differences between groups, and *t* tests were used to analyze continuous variables. All statistical tests were 2-tailed, and a p value <0.05 was considered significant. Interquartile ranges (IQRs) at the 25th and 75th percentiles were also determined. The positive predictive value of using only the laboratory portion of the CSTE case definition in Arizona was calculated.

Results

Study Population

ADHS received reports of 5,664 coccidioidomycosis cases from January 2007 through February 2008. Of the 5,664 reported case-patients, 851 (15%) were sent letters for enrollment, and 493 (9%) were successfully enrolled. Of the 851 patients who received enrollment letters, more than half (493 or 58%) were successfully enrolled; 41 (5%) refused to be interviewed; 15 (2%) were deceased, incarcerated, or incarcerated; 228 (27%) were lost to follow-up; and 74 (9%) were in the process of being contacted when the study ended. Interviewed case-patients were similar in age and sex to those case-patients who were not interviewed. However, the number of Native Americans and Hispanics was significantly lower among the interviewed patients than among those not included in the enhanced surveillance population (Table 1).

Comparing data from the interviewed patients with the Arizona population data from the US Census 2000 (*12*), we showed that 449 (91%) of those interviewed had health insurance at the time they sought care compared to 86% of the Arizona population (p<0.01). Interviewed patients differed slightly from BRFSS survey respondents: median age of interviewed patients was significantly lower (54 years vs. 58 years, respectively; p<0.01), and significantly fewer women were interviewed (odds ratio [OR] 1.3, 95% confidence interval [CI] 1.6–2.3). Also, persons with a diagnosis of coccidioidomycosis had lived in Arizona for a median of 12 years compared with BRFSS respondents, who lived in Arizona for a median of 22 years (p<0.01). Among the 493 interviewed patients, 97 (20%) were classified as immunocompromised at the time of illness; 140 (28%) reported a history of heart or lung disease; and 164 (33%) reported having no underlying disease at time of diagnosis (Table 2).

Effects on Patients

Interviewed coccidioidomycosis patients reported the following common symptoms: fatigue (84%), cough (67%), dyspnea (50%), and fever (54%). Patients sought healthcare a median of 11 days (range 0–2,669 days; IQR 2–31 days) after onset of symptoms. Median time between seeking healthcare and coccidioidomycosis diagnosis was 23 days (range 0–10,280 days; IQR 6–74 days). Thirteen (3%) patients did not know their diagnosis until ≥2 years after they had seen a doctor for their symptoms.

Patients reported a median of 2 visits (range 0–60 visits; IQR 1–3 visits) to a healthcare provider before coccidioidomycosis testing occurred. Symptoms lasted a median of 42 days (range 0–511 days; IQR 14–65 days) for patients

Table 1. Demographic characteristics of reported coccidioidomycosis patients compared with enhanced surveillance patients, Arizona, USA, January 2007–February 2008

Characteristic	Total reported, N = 5,664	Enhanced surveillance, n = 493	p value
Male sex, no. (%)*	3,093 (54)	259 (54)	0.7
Age, y			
Mean	51	52	0.2
Median	52	54	
Range	1.5–100 y	8 mo–100 y	
Race, no. (%)†			
White	4,845 (82)	395 (80)	0.2
African American	158 (3)	33 (7)	0.5
Asian or Pacific Islander	58 (1)	16 (3)	0.6
Native American or Alaska Native	110 (5)	11 (2)	<0.01
Other	37 (2)	37 (8)	<0.01
Unknown	0	1 (0)	
Hispanic ethnicity, no. (%)‡	319 (24)	23 (12)	<0.01

*Sex data were available for only 5,661 reported coccidioidomycosis cases.
†In Arizona, race and ethnicity are reported in separate variables. Therefore, race data do not include a specific category for Hispanic ethnicity but include Hispanics. Race is categorized as White, African American, Asian or Pacific Islander, Native American or Alaska Native, or Other. Race data were available for 2,664 reported coccidioidomycosis patients and for 481 enhanced surveillance patients.
‡In Arizona, race and ethnicity are reported in separate variables. Ethnicity is categorized as either Hispanic or non-Hispanic. Ethnicity data were available for 1,340 coccidioidomycosis patients and for 192 enhanced surveillance patients.

who had reconverted at the time of interview (n = 167); 157 days (range 4–5,224 days; IQR 110–277 days) for those who had not reconverted at the time of interview (n = 253); and 120 days (range 0–5,224 days; IQR 49–198 days) for the 2 groups combined (n = 420) (Table 3).

Of the 493 patients interviewed, 225 (46%) were employed; and 178 (36%) were retired. Of those employed, 167 (74%) missed a median of 14 workdays (range 0–365 workdays; IQR 5–30 workdays) because of their illness (Table 3). Of interviewed patients, 63 (13%) were attending school when their illness began; 33 (59%) of these students missed a median of 9 days of school due to their illness. When asked about their ability to perform their usual daily activities, 369 (75%) patients said that their illness prevented their performance of usual daily activities at some point during the illness. Among these patients, daily activities were interrupted for a median of 47 days (range 0–1,825 days; IQR 15–120 days) (Table 3).

Effects on Healthcare and the Economy

Almost half (46%) of the patients interviewed reported ≥1 visit to the emergency room during the course of illness. 111 (23%) first sought care in an emergency room. Approximately one fourth (26%) of patients visited a healthcare provider >10 times during the course of their illness. Two hundred patients (41%) were hospitalized overnight for their illness, and the median length of hospital stay was 6 days (range 0–306 days; IQR 4–10 days).

Data from the Arizona Hospital Discharge Database (*11*) show that 1,093 hospital visits occurred with a primary diagnosis of coccidioidomycosis in Arizona in 2007, accounting for a total of $53 million in hospital charges and a median of $35,000 per coccidioidomycosis-related hospital visit (Table 3). For the 1,735 visits with a primary or secondary diagnosis of coccidioidomycosis, total charges were $86 million, and the median charge was $39,000 per visit.

Knowledge of Coccidioidomycosis

Patients who knew about coccidioidomycosis before seeking healthcare were more likely to be diagnosed earlier than those patients who were unfamiliar with the disease (median 20 days [range 0–3,553 days; IQR 6–56 days] vs. 25 days [range 0–10,280 days; IQR 7–148 days], respectively; p = 0.04). Interviewed patients who had prior knowledge of coccidioidomycosis were also twice as likely (95% CI 1.0–3.2, p = 0.05) to request testing for coccidioidomycosis from their healthcare provider. White patients were more likely to have knowledge about coccidioidomycosis before diagnosis than were patients of other racial groups (95% CI 1.7–4.3, p<0.01).

In addition, compared with the general population, interviewed patients were more likely to learn about coccidioidomycosis from their social circles, families, friends, or co-workers (OR 2.3, 95% CI 1.8–2.9). In contrast, those persons contacted through BRFSS were more likely to hear about coccidioidomycosis from the media (TV, radio, newspaper, or Internet) than were persons with coccidioidomycosis (OR 3.3, 95% CI 2.4–4.6). Coccidioidomycosis patients were less likely than BRFSS respondents to have heard about coccidioidomycosis from their doctors (OR 2.2, 95% CI 1.3–3.6).

Table 2. Clinical and behavioral characteristics of enhanced surveillance coccidioidomycosis patients, Arizona, USA, January 2007–February 2008*

Characteristic	No. (%)
Preexisting condition	
Heart disease	62 (13)
Lung disease†	90 (18)
Asthma requiring inhaler	42 (10)
COPD or emphysema	27 (6)
Other	20 (4)
Malignancy	70 (14)
Transplant	11 (2)
HIV	9 (2)
Diabetes mellitus	72 (15)
None	164 (33)
Immunocompromised‡	97 (20)
Smoker	
Active	76 (15)
Past	256 (51)
Never	202 (41)
Unknown	12 (2)
Site of infection, n = 392	
Primarily pulmonary§	240 (65)
Disseminated¶	42 (15)

*N = 493. COPD, chronic obstructive pulmonary disease.
†Immunocompromised is defined as having HIV/AIDS, a solid-organ transplant, or a bone marrow transplant or taking chemotherapeutic medications, corticosteroid medications, or medications other than antifungals that suppress the immune system and decrease the inflammatory and defensive functions of the body, including, but not limited to, infliximab, as self-reported by patients.
‡Primary pulmonary infection is defined as infection specific to the lungs only. The entire site of infection, as self-reported by patients.
§Disseminated infection is defined as infection spread to other parts of the body, including the central nervous system, bone, and entire body, as self-reported by patients.

Treatment

Antifungal treatment for coccidioidomycosis was prescribed for 303 (61%) patients interviewed. Compared with patients who reported no common symptoms, patients who had symptoms were more likely to be treated with antifungal medication if they reported either chills (60% vs. 47%), shortness of breath (67% vs. 56%), or weight loss (75% vs. 58%; p≤0.02 for each). Those with sore throat were significantly less likely to be treated with antifungal medications than those without sore throat (32% vs. 66%, p<0.01). About 60% (299) of patients were treated with antibacterial agents. Of those, 92 (32%) received >1 course of antibacterial drugs (range 2–10 courses, IQR 2–3 courses).

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Table 3. Characteristics of enhanced surveillance coccidioidomycosis patients, and statewide hospital charges identified through the 2007 Arizona Hospital Discharge Database

Description	Mean	Median	Range	Interquartile range	Total
Days from symptom onset to diagnosis date, n = 472	209	65	0–10,281	22–143	
Days from first seeking health care to diagnosis date, n = 422	156	23	0–10,280	6–74	
Days of symptom duration,* n = 420	292	120	0–6,224	49–198	
Days missed from work, † n = 159	35	14	0–405	5–30	
Days missed from school, ‡ n = 18	17	8	0–120	3–15	
Days unable to perform daily activities, § n = 252	58	47	0–1,825	15–120	
Per visit hospital charges for coccidioidomycosis primary diagnosis, n = 1,003	$64,000	$33,000	$113–$1,474,798		$59 million
Per visit hospital charges for coccidioidomycosis primary or secondary diagnoses, n = 1,725	$49,000	$30,000	$113–$1,474,798		$86 million

*Symptom duration analyses includes patients who had recovered and those who had not yet recovered from their symptoms at the time of interview.
†Number of days missed from work was available for 159/187 patients who reported that they missed work due to their disease.
‡Number of days missed from school was available for 25/37 patients who reported that they missed school due to their disease.
§Number of days patients were unable to perform daily activities was available for 252/360 patients who reported that their illness interfered with their daily activities.

Comparison to CSTE Case Definition

Of the 493 patients interviewed, 469 (95%) met the CSTE clinical case definition. Thirteen (4%) case-patients reported no symptoms. Ten (2%) had only 1 symptom consistent with coccidioidomycosis but had no symptoms that met the case definition; 1 person had only 1 symptom unrelated to coccidioidomycosis. Case-patients who met the clinical case definition were similar to those who did not meet the case definition in age, race, ethnicity, and gender.

Discussion

This investigation provides the largest population-based estimate of the effects of coccidioidomycosis in Arizona. We identified substantial personal and economic costs due to coccidioidomycosis among Arizonans with respect to duration and severity of illness, healthcare use, and healthcare costs. We also found marked delays in diagnosis as well as long duration of symptoms.

In our cohort, persons with coccidioidomycosis had prolonged symptoms for a median of 120 days, substantially longer than previous reports that indicated that coccidioidomycosis symptoms typically last <21 days (fatigue may last longer) (*2*,*10*). A study conducted among US Navy SEALS, a presumably healthy and relatively young population, reported median symptom duration of 19 days (range 2–63 days) (*14*). Our investigation identified a high number of missed workdays (median 14 days, range 0–365 days, IQR 5–30 days) and days during which persons could not perform their daily activities (median 47 days, range 0–1,825 days, IQR 15–120 days). In a study among military members, persons with coccidioidomycosis lost an average of 35 days from work (*15*). These data support the finding that coccidioidomycosis greatly affects a person's ability to function and remain productive once the disease develops.

In addition, we found a substantial delay between symptom onset and disease diagnosis. The delay in seeking medical care needs to be addressed by increasing public education about the signs and symptoms of coccidioidomycosis and the importance of seeking care early to obtain an accurate diagnosis. Our data show that the delay between seeking healthcare and ordering a diagnostic test may also be shortened by patient education. Persons who knew about coccidioidomycosis before seeking healthcare were more likely to request coccidioidomycosis testing and were more likely to receive a diagnosis earlier than those who were not familiar with the disease. Our data show that 46% of patients sought medical care without a fever, making recognition of the disease difficult for physicians and patients and possibly contributing to delays in diagnosis. Additionally, the nonspecific manifestations of respiratory illness in coccidioidomycosis patients is indistinguishable from the manifestation of community-acquired pneumonia, which makes accurate diagnoses even more difficult (*16*).

Besides the effects on patients, this disease greatly affects the healthcare system. In our investigation, ≈25% of patients visited a healthcare provider >10 times during the course of their illness, and 41% of all interviewed patients were hospitalized. In 1993, a study conducted by Kurtz et al. showed that college students who had coccidioidomycosis visited their doctor an average of 7 times before the disease resolved (*17*). Similarly, Leake et al. found that patients >60 years of age had a median of 4 medical visits (range 1 to >30 visits) during the course of their illness (*18*). In this same study, 39% of patients were hospitalized for a median of 7 days. A study among military personnel by Crum et al. found that 22% of those with pulmonary disease and 40% with disseminated disease were hospitalized (*15*). Our study is consistent with this literature, but, being population-based, is more representative of the disease's effects on Arizona residents.

In addition to the costs generated by excess healthcare visits, we found the costs associated with hospitalizations

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to be higher than costs found in previous studies. Our data show hospital charges totaling $86 million (mean $49,000 per hospitalization) among Arizona patients who had primary or secondary diagnoses in 2007. This total is much higher than that found in a previous analysis, which showed total annual hospital charges of $2 million in 1998, increasing to $19 million in 2001 (*19*). Our data clearly show the growing costs of coccidioidomycosis and its effect on healthcare costs in Arizona.

Persons with a diagnosis of coccidioidomycosis reported living in Arizona for significantly fewer years (median 12) than a sample of the general population (median 22). This finding is consistent with previous studies, which showed that relatively recent relocation to Arizona from a non-disease endemic area is a risk factor for developing the disease (*8*,*20*,*21*). Leake et al. examined patients ≥50 years of age and identified a median duration of residence in Arizona of 6.5 years for coccidioidomycosis patients compared with 19.5 years for controls from the same geographic area (*18*).

We also found that the modified surveillance case definition used by Arizona is appropriate and has a high positive predictive value for the population in this coccidioidomycosis-endemic area. Arizona originally adopted a modified coccidioidomycosis case definition that includes only the laboratory criteria for several reasons. First, clinical information is rarely reported to public health agencies, and with >4,000 cases reported each year, obtaining this information for each case is resource intensive. Second, our experience suggests that most *Coccidioides* tests are performed on symptomatic patients (i.e., persons sick enough to seek medical attention). The data from this investigation confirm that our modified case definition is highly specific: 88% of cases reported to ADHS met both the laboratory and clinical criteria specified in the CSTE definition; the other 5% either had no symptoms or had symptoms that were inconsistent with the coccidioidomycosis case definition. These findings suggest that eliminating clinical criteria from the coccidioidomycosis case definition allows for simpler surveillance methods and requires fewer resources yet still accurately estimates prevalence and incidence of the disease in endemic regions.

Our investigation has several limitations. Coccidioidomycosis surveillance in Arizona requires a laboratory diagnosis of the disease. Because patients without a laboratory-confirmed diagnosis are missed, the number of reported coccidioidomycosis cases underestimates the actual number of cases. These reports come from outside sources, so a minor chance of error in data collection exists. Additionally, because case-patients reported to the health department are usually persons who are sick enough to seek medical attention for their symptoms and receive testing, they study is biased toward more patients with severe coccidioidomycosis cases and toward those with medical insurance. Furthermore, this enhanced surveillance data relied on self-reporting by patients. Because patients often lack medical knowledge or may refuse to answer questions during the interview, information reported may be missing or inaccurate. For instance, we relied on self-reported use of immunosuppressive medications, and those data were not verified by medical records or by physicians.

Self-reporting is subject to recall bias. However, most case patients were contacted within a few months of their diagnosis, minimizing recall bias as much as possible. In addition, because telephone interviews were conducted, the data are limited to information from persons who were at home and who had telephones. These factors might explain the underrepresentation of Native American and Hispanics in the enhanced surveillance cohort, although every effort was made to capture information from persons who spoke only Spanish. Table 1 shows that Native Americans were underrepresented in the enhanced surveillance sample compared with the statewide coccidioidomycosis cases reported from January 2007 through February 2008 (2% vs. 5%; $p<0.01$, a difference possibly caused by lack of telephone contact information in this community. Another possible contributor to the underreporting of Native Americans is the fact that tribal entities are not required to report coccidioidomycosis cases to the state health department, however, most tribes in Arizona do voluntarily report infectious diseases to ADHS. Last, the data from the BRFSS survey may not accurately reflect the general population because respondents tended to be older and were more likely to be female than the Arizona population reported in the US Census 2000 (*22*).

This population-based cohort investigation illustrates the severe effects that coccidioidomycosis has on patients, the healthcare system, and the economy in Arizona. The data emphasize the need for effective education campaigns aimed at the general public and healthcare providers to decrease delays in diagnosis of coccidioidomycosis, which would probably reduce unnecessary use of antimicrobial drugs, relieve patient anxiety, and enable early recognition and treatment of the disease. Furthermore, the data validate a case definition that uses only laboratory criteria for coccidioidomycosis surveillance in disease-endemic areas. This information could be used to propose changes to the national CSTE coccidioidomycosis case definition in other US disease-endemic areas and thus reduce resources needed for an accurate assessment of the extent of the disease and its effects.

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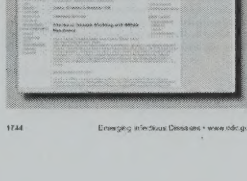

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Review

Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling

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Abstract

At present, infrasound (0–20 Hz) and low-frequency noise (20–500 Hz) (LFN, 0–500 Hz) are agents of disease that go unchecked. Vibroacoustic disease (VAD) is a whole-body pathology that develops in individuals excessively exposed to ILFN. VAD has been diagnosed within several professional groups employed within the aeronautical industry, and in other heavy industries. However, given the ubiquitous nature of ILFN and the absence of legislation concerning ILFN, VAD is increasingly being diagnosed among members of the general population, including children. VAD is associated with the abnormal growth of extra-cellular matrices (collagen and elastin), in the absence of an inflammatory process. In VAD, the end-product of collagen and elastin growth is reinforcement of structural integrity. This is seen in blood vessels, cardiac structures, trachea, lung, and kidney of both VAD patients and ILFN-exposed animals. VAD is, essentially, a mechanotransduction disease. Inter- and intra-cellular communication is achieved through both biochemical and mechanotransductive signalling. When the structural components of tissue are altered, as is seen in ILFN-exposed specimens, the mechanically mediated signalling is, at best, impaired. Common medical diagnostic tests, such as EKG, EEG, as well as many blood chemistry analyses, are based on the mal-function of biochemical signalling processes. VAD patients typically present normal values for these tests. However, when echocardiography, brain MRI or histological studies are performed, where structural changes can be identified, all consistently show significant changes in VAD patients and ILFN-exposed animals. Frequency-specific effects are not yet known, valid dose-responses have been difficult to identify, and large-scale epidemiological studies are still lacking.
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Keywords: Extra-cellular matrix; Actin; Tubulin; Collagen; Tensegrity

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1. Introduction

This review paper deals with the biological effects of infrasound (0–20 Hz) and low-frequency noise (LFN) (20–500 Hz). For the past 60 years, there has been much controversy and acrimonious debate over whether or not acoustical phenomena can cause extra-auditory effects on living organisms (Alves-Pereira, 1999). At present, the only officially (and legally) recognized consequence of noise exposure is hearing loss, albeit noise-induced annoyance, sleep disturbances and hypertension have been gaining more recognition over the past several years.

The scientific understanding of non-auditory, noise-induced biological effects can only be achieved if several obstacles are overcome. These obstacles pertain to the way the scientific community, in general, and biological scientists, in particular, view noise pollution and cellular signaling: noise only causes hearing impairment and cellular signaling is accomplished only through biochemical pathways. These untenable positions are powerful (scientific) hindrances that have impeded valuable research efforts. There are other key obstacles related to the awareness and recognition of ILFN as an agent of disease, but these are associated with the political, financial and social features of our collective societies and are, therefore, beyond the scope of this report.

Much of the literature pertaining to this field of study has been produced by non-English-speaking authors. Although the majority possess an abstract in English, full translations of all these scientific papers (e.g., from Chinese, Russian, Slovenian, Japanese and Polish) have been difficult to obtain. Additionally, many of the early papers produced by this team (from 1950 through 1969) were published in Portuguese with abstracts in English. Hence, several scientific papers in this review are only referred to abstracts.

Herein will be demonstrated that excessive exposure to ILFN causes extra-auditory pathology, specifically, vibroacoustic disease (VAD), and that the physiological and biological basis for this disease can only be understood if the concept of mechanotransduction cellular signalling is taken into account.

2. Noise pollution

Historically, it is understandable that noise exposure has always been associated with hearing loss. According to the Epic of Gilgamesh, a Babylonian king who lived in 2700 BC, the Great Flood was brought to

the planet Earth because the demi-gods were unable to sleep due to the noise produced by humans (Sanders, 1972). In Ancient Greece (600 BC), metalwork involving hammers was banned within city limits (Ward, 1973). In Ancient Rome, legislation existed pertaining to the noise associated with the iron wheels of wagons that disrupted sleep, while in certain cities of Medieval Europe, horse carriages were not allowed during night time (World Health Organization, 1999).

But with the advent of machines, a different kind of noise became ubiquitous. Sometimes, a low rumble from public transportation systems in urban and suburban settings, sometimes a hum from an air-conditioning unit, a refrigerator or a fan, this noise does not cause hearing impairment. But it may cause annoyance. As a definition of annoyance, the European Commission Noise Team (2000) maintains: "Annoyance is the scientific expression for the non-specific disturbance by noise, as reported in a structured field survey. Nearly every person that reports to be annoyed by noise in and around its home will also experience one or more of the following specific effects: Reduced enjoyment of balcony or garden; When inside the home with windows open: interference with sleep, communication, reading, watching television, listening to music and radio; Closing of bedroom windows in order to avoid sleep disturbance. Some of the persons that are annoyed by noise also experience one or more of the following effects: Sleep disturbance when windows and doors are closed; Interference with communication and other indoor activities when windows and doors are closed; Mental health effects; Noise-induced hearing impairment; Hypertension; Ischemic heart disease." Hence, the parameter "annoyance" is, in itself, of a subjective nature.

2.1. dBA versus dBLin

Quantifying noise based on the subjective awareness of humans has guided the vast majority of noise-related biomedical studies. In fact, the foundational unit of noise legislation—the dBA—is grounded solely in the acoustical phenomena that humans can perceive with their ears, i.e., sound. The "A" on the dB unit refers to the usage of a filtering or weighting network that simulates human hearing and, thus, its purpose is to measure the acoustical phenomena present in the environment that can cause hearing impairment. Humans are considered to perceive sound between 20 and 20 000 Hz, but non-uniformly, i.e., there is an acoustical window where the human ear is most susceptible: 500–8000 Hz. It is within these frequency bands that hearing impairment occurs—legal deafness is assessed at 4000 Hz. Using the A-filter desemphasizes all values of acoustical energy that occur below 500 Hz, and ignores all acoustical energy below 20 Hz. Fig. 1 demonstrates the usefulness of the dBA unit.

Scientifically, the acoustical environments of the cockpit and train shown in Fig. 1 cannot be considered comparable because the distribution of acoustical energy throughout the different frequency bands is quite distinct. This distinction is not taken into account if the acoustic environments are solely described by a dBA value, as is clearly illustrated in Fig. 1. Nevertheless, it is this dBA value that most noise-related legislation requires to assess the risk of noise exposure, and it is this same dBA value that most biomedical scientists use to describe their experimental acoustical environments.

The usage of the dBA value for scientific study can only be justified if the purpose of the study is related to effects on, or via, the human auditory system. If the purpose is to study the biological effects of noise, then describing acoustical environments merely in terms of a dBA value is a scientifically unsound methodology. Example: Two different and independent teams of researchers expose the same animal population, in equal conditions, to an acoustical environment described as "80 dBA". Is it scientifically valid to compare the results of these two studies? As the example given in Fig. 1 clearly demonstrates, the answer is no, but the scientific community at large does so in its numerous published papers. At present, the general consensus of mainstream science is (still) that noise-induced extra-auditory pathology is a controversial, contradictory and inconclusive subject, hence non-existent and, therefore, not subjected to legislation (Alves-Pereira, 1999, 2005).

2.2. What you can't hear, won't hurt you

The title of this section is a quote, from Campanella (2001). There is no scientific evidence supporting this statement, and there is a colossal amount of scientific evidence indicating otherwise. Nevertheless, leading

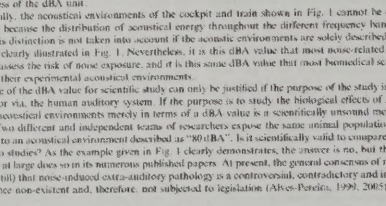

Fig. 1. Spectral distribution in 1/3 octave bands, without A-weighting (dB-Linear), obtained in (a) cockpit of the Airbus-340 (Alves-Pereira et al., 2004a), at cruise flight, and (b) in a Lisbon commuter train while in motion, in the passenger position (Alves-Pereira et al., 2004a). The two bars on the right compare the overall (Lin) values in both dBA and dBLin, i.e., with and without A-weighting, respectively. As can be observed, the dBA values are the same while the dBLin values differ by 12 dB. The value in dBA represents what the human can *hear* while the dBLin value indicates the amount of acoustic energy present in the environment. Hence, in both cockpit and train, what will be *heard* will be the same, but the individual in the train will be exposed to a larger amount of acoustical energy.

acousticians still opt to ignore this fact, and persist on perpetuating the notion that if hearing protectors are properly worn, no noise-induced extra-auditory effects will arise (von Gierke and Mohler, 2002).

In fact, over the past 25 years, research conducted in Portugal (and, independently, in other countries, such as the Soviet Union-Russia, Japan and China) has been showing that acoustical phenomena, whether it is perceived by the auditory system, or not, can indeed cause organic changes in biological tissue (Alves-Pereira, 1999). As a result of the efforts of a multidisciplinary team of scientists, including medical doctors, mathematicians, physicists, biologists, engineers, and acousticians, a pathological entity has been defined—VAD (see below) (Castelo Branco and Rodriguez Lopez, 1999a; Castelo Branco and Alves-Pereira, 2004a).

VAD is specifically caused by excessive exposure to ILFN (taken to be all acoustical phenomena occurring from 0 to 500 Hz). However, the acoustical energy responsible for VAD is never taken into account by standard noise measurements. As explained above, the scientific community and legislative bodies insist in accepting acoustical environments described merely in terms of a dBA value. Hence, they also perpetuate the erroneous notion that noise only affects the ear. The end result is a multitude of studies, focused on the biological effects of noise, but without the necessary methodology to allow them to be compared amongst each other. In the rare cases where information on the frequency distribution is provided, spectra are often measured in dBA units, which, once again de-emphasizes the amount of acoustical energy actually present in the environment, but gives a nice estimate of the noise being processed by the ear.

The scientifically unsubstantiated, but prevalent notion that noise only affects hearing has had a tremendous impact on individuals who develop ILFN-induced pathology. The gravity and magnitude of this issue will be further discussed in later sections.

2.3. Acoustic pollution

It is high time that scientists begin to view acoustical phenomena within a framework usually applied to electromagnetic phenomena. Within the electromagnetic spectrum, the human eye perceives light in a certain range of frequencies, just as within the acoustical spectrum, the human ear perceives sound in a specific range of frequencies. There exist electromagnetic phenomena that are not perceived by any of the human senses during the actual exposure (e.g. X-rays), and yet, excessive exposure to X-rays can cause severe biological damage. Without any subjective perception of the agent of disease, humans can nonetheless develop pathology caused by that unperceived agent of disease. While this is obviously true, it is apparently forgotten when one deals with acoustical phenomena, specifically ILFN. This may, in fact, be a unique case in the history of

Medicine, whereby the agent of disease is considered to only have an effect on the host, if the host perceives that same agent of disease.

That specific electromagnetic frequencies influence specific types of tissues is a well-known fact, and is the basis for numerous medical diagnostic and therapeutic tools. Science has data regarding which frequencies cause which types of pathology, for example, ultraviolet radiation can cause ocular disease, such as cataracts. But in the acoustical spectrum, the only frequencies that are considered to pathologically affect humans are within the audible range (infrasound is beyond the scope of this paper), and all of them are focused on the hearing apparatus. Acoustical phenomena within the ILFN range can affect several organs and tissues, but this depends also on the frequency of the acoustical event because every organ and tissue has its own resultant properties (e.g., resonance frequency and acoustical impedance).

Noise protection is, of course, focused exclusively on avoiding hearing impairment and minimizing annoyance. Thus, in some work environments where ILFN values can reach up to 90 and 100 dB (Alves-Pereira et al., 2004b), the only protection provided are hearing protectors. Returning to the analogy with the electromagnetic spectrum, this would be equivalent to providing dark glasses to individuals who work with X-rays.

Clearly, a new attitude toward noise and noise pollution is urgently required. The term *acoustic pollution* reflects the real nature of acoustical phenomena and how it impacts on humans. Acoustic pollution encompasses those frequencies that, being audible to humans, can cause hearing impairment. But it also includes all the other acoustical phenomena, ILFN and ultrasound, which may, or may not, pathologically affect human beings. Acoustic pollution deals with the entire acoustical landscape, and not just with the acoustical phenomena that produce sound to the human perception. In fact, where ILFN is concerned, dosimetry studies cannot be adequately carried out if the notion of acoustic pollution is not well understood. (See below.)

3. Chemical and mechanical cellular signalling

When new biological models successfully explain a larger number of biological events, usually that model is adopted and older, less applicable models are discarded. While this may seem like a logical course of action, sometimes the inertia associated with human nature to accept change conditions an impediment.

The conventional model of the biological cell assumes it to be an elastic cortex surrounding a viscous cytoplasm that contains an elastic nucleus at the centre. This is a "continuum" model and assumes that the load-bearing elements are infinitesimally small compared to the overall size of the cell. Although this model has successfully explained many cellular behaviours, it does not take into account the distinct functional contributions of the cytoskeleton network.

For the past 30 years, the Ingber Laboratory at Harvard Medical School has been demonstrating that the "balloon" model of the cell is inadequate. Instead, a cellular model based on tensegrity architecture has been proposed and has been successfully explaining many cellular and tissue behaviours, both during normal metabolic activity and in disease (Ingber, 2003, 2003a, b, among others). This "new" cellular model is crucial to understanding the type of pathology developed by ILFN-exposed biological organisms because only the tensegrity model adequately explains how mechanical signals are transduced over cells and tissues.

At present, cell and tissue regulation is considered to be largely mediated by molecular conformations, intermolecular interactions, and linear signal transduction cascades. But this is proving to be a reductionist approach because the neglected mechanotransduction cellular signalling also plays a key role in cell and tissue communication (Ingber, 2003a). Modern medicine focuses on the importance of genes and chemical factors to control and explain tissue physiology and disease development. The "genome euphoria" (Ingber, 2003) disregards the physical (structural and mechanical) properties of cells and tissues despite the fact that in order to maintain normal cell behaviour (motility, growth, apoptosis), the ability of cells to sense and respond to mechanical stresses is of critical importance (e.g., Wang et al., 1993; Matthews et al., 2004; Alenghat et al., 2004).

3.1. Tensegrity architecture

At the turn of the 20th century, mechanical interpretations of biological behaviour were a common methodology. Form and function of cells and tissues were of great importance to understanding biological

processes. However, as the field of molecular biology developed, biochemicals and genes became the forefront of scientific interest. "Medicine went from a holistic view of describing the relation between form and function to a much more reductionist view of describing what life is made of. And the mechanics were thrown out like the baby with the bathwater" (Ingber, 2004b).

The term *tensegrity* (tensile integrity) was coined by R. Buckminster Fuller, "father" of the geodesic dome in Architecture, and of the bucky ball in Physics (Fuller, 1975). Tensegrity is a form of structural stabilization that minimizes weight by using discontinuous-compression and continuous-tension, as opposed to continuous-compression. To visualize the difference, compare a brick-on-brick type of construction (continuous compression) with a stick-and-elastic construction of a geodesic dome, where the sticks are the discontinuous-compression elements while the elastics provide the continuous tension. Anchoring points, or nodes are essential to tensegrity structures because it is through these points that mechanical forces are transduced throughout the constituent compression and tensile elements. Any local, external perturbation of a tensegrity structure will result in a well-organized redistribution of tensional forces throughout the entire structure, with the purpose of maintaining structural integrity.

3.2. Cellular tensegrity architecture

Cellular cytoskeletons (CSK) form isomeric networks of microtubules, intermediate tubules, intermediate filaments, and actin. Forces generated within the CSK are involved in cytoplasmic organelle transportation (mitochondria and synaptic vesicles), chromosome movement during mitosis, and tension generation in the muscle cell contraction process (Ingber, 2003a). The CSK receives signalling from other cells through cell–cell junctions, and from the extra-cellular matrix (ECM), through cell–matrix junctions. Table 1 summarizes the properties of both types of junctions.

In the CSK, microfilaments form a mesh network of fine cables that constitute the continuous-tension elements (elastics) of the cellular tensegrity model. The compression elements (sticks) are formed by microtubules that are anchored to the ECM through transmembrane proteins called integrins, at sites called focal adhesions. Integrins differ from other cell–surface receptors because they bind with relatively low affinity ($K_d \approx 10^6$–10^7 l/mol), and their highest concentration is on cell surfaces.

Previous studies have probed the functioning of focal adhesion integrin receptors through magnetic twisting cytometry (Wang et al., 1993) and magnetic microneedle manipulation followed by magnetic pulling cytometry (Matthews et al., 2004). At focal adhesions, CSK and ECM possess structural linkages in the form of integrin cell–surface receptors. Mechanical forces applied directly to integrin cell–surface receptors alter cell biochemical and gene expression in a stress-dependent way (Ingber, 2003, 2003a, b; Wang, et al., 1993;

Table 1
Properties of cell–cell anchoring junctions (adherens junction and desmosomes) and of cell–matrix anchoring junctions (focal adhesions and hemidesmosomes)

	Cell–cell		Cell–matrix	
Junction	Adherens junction	Desmosome	Focal adhesions	Hemidesmosomes
Intracellular (CSK) attachment filaments	Actin	Intermediate filaments	Actin	Intermediate filaments
Transmembrane adhesion protein	E-cadherin	Cadherin (desmoglein, desmocollin)	Integrin	Integrin ($\alpha_6\beta_4$, BP180)
Extracellular ligand	Cadherin (adherent cell)	desmoglein, desmocollin (adherent cell)	ECM proteins	ECM proteins
Intracellular anchor protein	$\alpha\beta$-catenins, vinculin, γ-actinin, γ-catenin	desmoplakins, γ-catenin	talin, vinculin, α-actinin, filamin	Plectin, BP230

Matthews et al., 2004; Alenghat et al., 2004). When the same forces are applied to other types of membrane receptors, there is no such effect.

External forces applied to integrins can activate intercellular signalling pathways, such as, protein tyrosine phosphorylation, ion fluxes, cAMP production, and G protein signalling (Ingber, 2003, 2003a, b; Wang, et al., 1993; Matthews et al., 2004; Alenghat et al., 2004). These integrin linkages allow for mechano-chemical transduction signalling that produce changes in cell form and function. This type of intracellular signalling is a critical regulator of cellular biochemistry, gene expression and tissue development (Ingber, 2003, 2003a, b; Wang, et al., 1993; Matthews et al., 2004; Alenghat et al., 2004). There is a large variety of mechanochemical-transducing integrin receptors molecules, each type of integrin only binds to one ECM macromolecule, and cell-type specificity modulates integrin binding activities, i.e., in fibroblasts, ligands bind specifically to collagen, fibronectin and laminin. Hemidesmosomes (connecting the basal lamina to adjacent cells) are integrin receptors but that do not bind to the CSK through the actin cortex. Instead, hemidesmosome integrins connect directly with intermediate filaments. In the CSK, these are responsible for helping individual microtubules from buckling under compression, and link the nucleus to the surface membrane. Desmosomes connect intermediate filaments from cell to cell. The biological explanation for some diseases based on mechanotransduction impairment has already been successfully advanced (Ingber, 2003, 2003a, b).

4. VAD

VAD is a systemic pathology, caused by excessive exposure to ILFN, and characterized by the abnormal proliferation of collagen and elastin, in the absence of an inflammatory process. VAD has been diagnosed in aeronautical technicians (Castelo Branco, 1999a), pilots and flight attendants (Araújo et al., 2001), as well as in an islander population exposed to environmental ILFN (Torres et al., 2001). Cases of VAD have also been documented among ship workers (Arnot, 2003) and in residential areas (Araújo et al., 2003, Monteiro et al., 2004).

4.1. Brief chronology of scientific enquiry over the past 25 years

In 1980, co-author Castelo Branco was appointed chief medical officer at an aircraft manufacturing, repair and rework facility (OGMA), owned and operated by the Portuguese Air Force, and employing around 3500 workers. The first step was to visit the workstations of all employees to assess the nature of the different occupational hazards, possible emergency situations that could arise, and types of required worker protection.

After maintenance is performed on an aircraft, Quality Control personnel carry out manufacturer's procedures while the aircraft is stopped on the tarmac, and has its engines test run at all possible speeds. During one of these run-up tests (EA3B, with afterburn) Castelo Branco observed a worker beginning to walk aimlessly, without purpose, and in the direction of the turbines. A co-worker grabbed him by the arm before he got too close, and the incident remained at that. After the run-up test, the co-worker was questioned about what had happened. Apparently it was not a rare occurrence, and in the 1960s someone *had not* been caught in time, which led to a fatality. The non-purposeful movements exhibited by the worker appeared to Castelo Branco to be of an epileptic nature.

OGMA was founded in 1918 and, since the 1960s, detailed medical records are kept for all workers (administrative and technical). Based on the observation during the run-up test, the second step was to survey all medical records to count how many technicians had previously been diagnosed with late-onset epilepsy, as detailed in their medical files. In the Portuguese general population, the incidence of epilepsy is 0.2%. In the group of 306 aircraft technicians employed at OGMA, 10% had been previously diagnosed with late-onset epilepsy (GIMOGIMA, 1984a). Here began this team's enquiry into ILFN-induced pathology.

4.1.1. 1980

- Establishment that 10% ($N = 306$) of the aircraft technicians employed at OGMA had been previously diagnosed with late-onset epilepsy (GIMOGIMA, 1984a).

- Initiated neurophysiological examinations. The results from brainstem auditory evoked potentials (BAEP) were initially difficult to interpret, given their large dispersion. To better evaluate the BAEP recordings, taxonomic distances using clustering algorithms, and multivariate analyses of action currents distributions were applied, and a standardized method was developed using a control population (Castelo Branco et al., 1985; Marvão et al., 1985).

4.1.2. 1984–1988

- Publication of the first articles on initial findings under the team name of GIMOGMA[1]: Epilepsy (GIMOGMA, 1984a), BAEP study (GIMOGMA, 1984b), and hyper-sensibility to noise (GIMOGMA, 1984c), otherwise known as noise intolerance or annoyance. A vascular involvement began to be suspected.

Until this point, it was thought that the neurological pathology observed in this group of workers, initially termed "vibration disease", was due to excessive exposure to vibration. Neurological parameters continued to be assessed.

- Studies showed abnormal magnetic resonance imaging of the central nervous system (Cruz Mauricio et al., 1988) and cognitive potentials (P300) (Moniz Botelho et al., 1988) in aircraft technicians.
- Other, non-neurological changes were identified, including damaged dental alveolar structures (Cortez-Pimentel and Castelo Branco, 1988); haemostasis and coagulation changes (Crespo et al., 1988), and abnormal retinal angiography (van Zeiler et al., 1988). The latter two suggested the pathology was of a vascular nature.
- Four cases of pleural effusion developed in these workers, all of unknown aetiology. They exhibited an atypical response to standard therapeutics, and endured unusually prolonged recovery periods.

During these years, "systemic vibration disease" was the term used to identify the pathology observed in aircraft technicians (Pimento et al., 1988). This meant that the health problems these workers were developing were not necessarily restricted to the neurological system.

- September 1987: Autopsy of an aircraft technician (Castelo Branco, 1999b). The plethora of scientific data bequeathed by this deceased patient disclosed the real extent of this pathology: 11 scars of previous silent infarct events, two previously undetected malignant tumours (kidney and brain), thickened blood vessel walls, thickened pericardium, and focal lung fibrosis.

4.1.3. 1989–1992

During this period, it was determined that the fundamental agent of disease to which aircraft technicians were exposed was ILFN (Bento Coelho et al., 1994), hence, the pathological entity was, again, renamed: "whole-body noise and vibration syndrome" (Castelo Branco, 1992).

- The thickened blood vessels and pericardium found in autopsy prompted echo-imaging studies, namely echocardiography for assessing pericardial thickening. All aircraft technicians presented abnormal pericardial and or cardiac valve thickening (Araújo et al., 1989).
- Carotid angiodynography was used to assess carotid thickening (Albuquerque et al., 1991; Carmo et al., 1992). Simultaneously, other populations occupationally exposed to ILFN began to be studied, such as helicopter (Carmo et al., 1992) and military (Canas et al., 1993) pilots.
- Wistar rats were chosen as animal models to investigate the effects of ILFN exposure on the respiratory tract, in an attempt to explain the atypical cases of pleural effusion, of unknown aetiology.

[1]GIMOGMA – Grupo de Investigação Médica dos OGMA – was the acronym for the medical research team that began its activity at OGMA, and that today is represented by the Centre for Human Performance.

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4.1.4. 1993–1999

In 1993, during a scientific meeting sponsored by our team, the term "vibroacoustic" was proposed for this pathological entity (Castelo Branco and Rodriguez Lopez, 1999a), and "vibroacoustic syndrome" became the new name for the ailment observed in aircraft technicians and, now, also in aircraft and helicopter pilots (Castelo Branco et al., 1996).

- Animal studies showed that the respiratory tract could be considered a primary target for ILFN: abnormal amount of fibrosis/collagen was ubiquitous in trachea, lungs and pleura; damaged (sheared) tracheal and bronchial cilia; fused actin-based microvilli of tracheal and bronchial brush cells (Sousa Pereira et al., 1998a; Grande et al., 1998). The atypical cases of pleural effusion were partially explained by morphofunctional impairment of pleural microvilli (Sousa Pereira et al., 1999b), as well as of pleural phagocytic capabilities (Oliveira et al., 1999).
- Additional neurological disorders were identified in ILFN-exposed populations, such as the existence of the palmo-mental reflex, usually only seen in primates, newborns, and the elderly (Martinho Pimenta et al., 1999c); balance disturbances (Martinho Pimenta et al., 1999b), and facial dyskinesia induced by auditory stimuli (Rosado et al., 1993; Martinho Pimenta and Castelo Branco, 1999c).
- The genotoxicity of ILFN was demonstrated in both human (Silva et al., 1999, 2002a) and animal models (Silva et al., 2002b), and was confirmed by teratogenic features in mice (Castelo Branco et al., 2003 g).
- Echocardiography was deemed an unreliable diagnostic tool because there is no established procedure to assess pericardial thickening and, thus, technician subjectivity introduced a large factor of error.
- The first human pericardial fragments were studied in VAD patients who required cardiac bypass surgery for other reasons (See below): abnormal amounts of collagen as well as the neo-formation of an extra layer of tissue was shown to be the cause underlying the pericardial thickening, providing anatomical confirmation of the autopsy and echo-imaging observations (Castelo Branco et al., 1996).
- Medical files of all aircraft technicians were chronologically reviewed since their admittance to OGMA. On-the-job accidents and incidents were correlated with the existence of unmonitored ILFN exposure of the workforce (Alvarez et al., 1993), and the clinical phases of the disease were outlined (Castelo Branco and Martinho Pimenta, 1995).

In 1999, the name "VAD" was adopted, and the journal Aviation, Space & Environmental Medicine dedicated a supplemental issue to this new pathological entity (Castelo Branco et al., 1999d).

4.1.5. Since 2000

- Other ILFN-exposed professionals were studied, such as civil aviation pilots and cabin crewmembers, confirming echocardiography results of aircraft technicians and military pilots (Araujo et al., 2001).
- More neurological pathology was identified: VAD patients were found to be unable to hyperventilate when in the presence of excessive CO_2 (Reis Ferreira et al., 2003a).
- Mechanically induced cellular death was identified in the pericardia of VAD patients and it was hypothesized that this situation could be related to the large incidence of auto-immune disorders in these patients (Castelo Branco et al., 2005b).
- Further rat studies suggested that fusion of cochlear cilia (actin-based structures) may provide a biomechanical explanation for noise intolerance, or annoyance (Castelo Branco et al., 2003b).
- The first case of large-scale environmental exposure to ILFN appeared in Vieques, Puerto Rico (Torres et al., 2001). Here, ILFN was caused by military training exercises. An isolated case came from Dublin, Ireland, where buses where the source of ILFN and induced VAD in a home-maker (Monteiro et al., 2004). Another from Lisbon, where ship-to-silo and silo-to-ship loading of cereals produces ILFN in a home where both parents and 10-year-old child exhibited VAD-related signs and symptoms (Araujo et al., 2004).
- All bronchoscopic examinations of VAD patients disclosed lesions that, upon analysis, demonstrated the existence of abnormal amounts of collagen, and neo-formation of vascular beds. Disrupted collagen fibers were observed and correlated with a positive testing of anti-nuclear antibodies, providing a deeper understanding of auto-immune processes (Monteiro et al., 2004a).

4.2. Clinical stages of VAD

In order to identify the clinical stages of VAD, as observed in aeronautical technicians, a systematic and detailed review of the medical files pertaining to the initial group of 306 aircraft technicians was undertaken in the mid 1990s. This group of 306 male individuals were all employed by OGMA for more than 10 years, and were submitted to rigorous selection criteria, as per Table 2 (Castelo Branco, 1999a).

A group of 140 technicians (average age of 42 years, SD = 10.4) remained after the application of selection criteria, i.e., 166 individuals were excluded. The medical files of these 140 technicians were comprehensively and chronologically reviewed. Simultaneously, a sociologist and a social worker interviewed family and friends to obtain additional information on the individual's behaviour outside his professional activity. The methodology to obtain a correspondence between sign/symptom and years of occupational exposure was the 50% cutoff, i.e., the sign symptom was included in the list if it was identified in 50% ($N = 70$) of the study population. Thus, referring to Table 2, after 1–4 years of occupational exposure, at least 70 of those 140 individuals developed bronchitis, in smokers and non-smokers alike (smokers in study group $N = 45$). Or, after 10 years of occupational activity, at least 70 exhibited headaches and nose bleeds. It should be emphasized that these signs and symptoms are not mutually exclusive, and most VAD patients suffer from more than one or two of these clinical situations, simultaneously (Castelo Branco, 1999a; Castelo Branco and Alves-Pereira, 2004a).

Table 3 refers to the signs and symptoms developed specifically by aircraft technicians working the standard 8 h/day, 5 days/week. Not all ILFN-exposed workers have this exposure schedule. For example, ship machinists can spend 3 weeks onboard ship (i.e., exposed to substantial ILFN-rich environments) and 2 weeks at home (i.e., presumably not in ILFN-rich environments) (Arnot, 2003). Other professional activities exist where the ILFN-exposure time pattern is not the standard 8-h/day exposure, such as with submarine and oil

Table 2
Conditions for study population exclusion (Castelo Branco and Rodriguez Lopez, 1999a)

Conditions	Comments
Streptococcal infections	Due to their propensity to induce extra-cellular matrix changes
Diabetes mellitus	Same as above
Pre-existing cardiovascular disease	But not labile hypertension, because it is suspected to be a marker of individual susceptibility, and because lesions are distinct from those caused by established hypertension
Tobacco abuse	Smokers of more than 20 cigarettes a day
Alcohol abuse	Drinkers with more than a liter of wine per day (10–12% alcohol content)
Drug use	Users of any recreational or psychotropic drug

Table 3
Data from a group of 140 aircraft technicians

Clinical stage	Sign/symptom
Stage I-Mild (1–4 years)	Slight mood swings, indigestion and heart burn, mouth, throat infections, bronchitis
Stage II-Moderate (4–10 years)	Chest pain, definite mood swings, back pain, tongue, fungal, viral and parasitic skin infections, inflammation of stomach lining, pain and blood in urine, conjunctivitis, allergies
Stage III-Severe (>10 years)	Psychoneurodisturbances, hemorrhages, of nasal, digestive and conjunctive origins, varicose veins and hemorrhoids, duodenal ulcers, spastic colon, decrease in visual acuity, headaches, severe joint pain, intense muscular pain, neurological disturbances

ILFN-exposure time (years) refers to the amount of time it took for 70 individuals (50%) to develop the corresponding sign or symptom (Castelo Branco, 1999a).

rig operators, astronauts, and environmental exposures in residential areas, where exposure can be continuous over long periods of time, and exists during sleeping hours. In these cases, the evolution of signs and symptoms could be greatly accelerated. For example, in the case of a Dublin homemaker, epileptic seizures consistent with VAD developed after 3 years of residence within a ILFN-infested home (Monteiro et al., 2004). If the ILFN exposure is environmental and/or leisurely, the standard 8 h/day model is also not applicable. Moreover, since different ILFN environments have unique frequency distributions, the fact that some frequency bands may be more predominant than others (i.e., concentrate more acoustical energy) can lead to the development of slightly different pathology.

4.3. Pathology associated with VAD

Other important pathologies were identified among these 140 aircraft technicians, but since they were not identified in 50% of the population, they were not included in Table 3. Nevertheless, their incidence is clinically important. Some kind of respiratory insufficiency was found in 24 of the 140 professionals, 11 were smokers. In 10 of the 24 cases, a mere light physical effort was necessary to produce symptoms. Notably, only 45 of the 140 individuals were smokers, 38 of which had over 20 years of occupational ILFN exposure.

Late-onset epilepsy was diagnosed in 22 individuals, some of whom saw their seizures subside when away from their workstation. Reflex epilepsy due to vibratory stimulus (Martinho Pimenta and Castelo Branco, 1999c) and visual stimulus was observed in two individuals. Auditory stimuli did not trigger seizures but, in some cases, triggered rage reactions and movement disorders (Martinho Pimenta and Castelo Branco, 1999d,e). Balance disturbances were also a common complaint, identified in 80 individuals, although the severity of the balance disturbance ranged from dizziness to severe vertigo (Martinho Pimenta et al., 1999f). Unique and sudden episodes of non-convulsive neurological deficit occurred in 11 individuals. These were diagnosed as cerebral ischaemic vascular accidents, which was compatible with imaging studies. EEG and multi-modal evoked potentials showed considerable power changes that were in agreement with clinical psychological and neurological evidences. Delays in multi-modal evoked potentials (including endogenous), observed in all 140 patients, are a sign of progressive neurological deterioration and early aging process, as is the appearance of the archaic palmo-mental reflex, that affects about 40% of these 140 patients.

Endocrine disorders, the most common being thyroid dysfunction, were identified in 18 cases. The overall national Portuguese rate for adult thyroid dysfunction is 0.97% vs. the 12.8% identified in our group of 140 technicians. Similarly, diabetes was seen in 16 individuals (average age 39 years, SD = 7.8) (11.4%), while the overall national rate for a similar age-group is 4.6% (Castelo Branco, 1999a). Among the 140 professionals, 28 had malignant tumours. Five of these 28 individuals exhibited simultaneous tumours of different types. All CNS tumours ($N = 5$) were malignant gliomata, and all respiratory system tumours were squamous cell carcinomas (3 in lung, 1 in larynx). To date, and to the authors' knowledge, a total of 11 VAD patients have developed respiratory tract tumours: 9 in the lung, and 2 in the glottis (3 smokers), *all* have been squamous cell carcinomas (Mendes et al., 2004; Reis Ferreira et al., 2005). Other tumours were found in the stomach ($N = 10$), colon and rectum ($N = 9$), soft tissue ($N = 1$), and bladder ($N = 1$) (Castelo Branco, 1999a). All digestive system tumours were low-differentiated adenocarcinomas. These data led to the investigation of the genotoxicity of ILFN. In both human (Silva et al., 1999, 2002a) and animal (Silva et al., 2002b) models, ILFN induced an increased frequency of sister chromatid exchanges, effectively demonstrating that ILFN is a genotoxic agent.

More recently, in 2003, a new pathological sign was identified among VAD patients: decreased respiratory drive (Reis Ferreira et al., 2003b; Castelo Branco et al., 2003b). To date, pulmonary function tests are normal in VAD patients, except the $P_{0.1}(CO_2)$ index and the metacholine reactivity test. The $P_{0.1}$ (CO_2) index is a measure of the inspiratory pressure (or suction) developed at the mouth, 0.1 s after the start of inspiration. This initial respiratory drive originates in the autonomic (or involuntary) pathway of the neural control of the respiratory function. By rebreathing CO_2, normal individuals would present a minimum six-fold increase of the $P_{0.1}(CO_2)$ index when compared to normal $P_{0.1}$. If the neural control of respiration is compromised, then a less-than six-fold increase would be expected in the $P_{0.1}(CO_2)$ index (Calverly, 1999; Cotes, 1993; Gibson, 1996). In VAD patients, all $P_{0.1}(CO_2)$ index values are below 50%, when normal values would be above 60%.

Lastly, the issue of auto-immune diseases in ILFN-exposed individuals. In the electron microscopy studies of VAD-patient pericardial fragments, non-apoptotic cellular death was frequently observed (Castelo Branco et al., 2003c) (see below). Instead, biomechanical forces seemed to be responsible for the images of burst cells, with live organelles and no surrounding plasma membrane. Under these circumstances, the appearance of auto-immune diseases in these patients is not unreasonable. Indeed, previous studies have shown that ILFN exposure induces an accelerated onset of lupus in lupus-prone mice (Agnas et al., 1999a). Lupus has also been identified in flight attendants (Araújo et al., 2001), and in entire families of islanders exposed to environmental ILFN (Torres et al., 2001). Vitiligo is another common finding, especially in the ILFN-exposed islander population. Vitiligo is associated with immune changes of CD8 and CD4 lymphocyte populations. These immune changes have also been observed in ILFN-exposed workers (Castro et al., 1999) and animal models (Agnas et al., 1999b). Other authors have also corroborated the existence of auto-immune processes in noise-exposed workers (Matsumoto et al., 1959, 1992; Jones et al., 1976; Soutar et al., 1974; Lippmann et al., 1973).

4.4. Some important considerations on behalf of VAD patients

Legally, the only pathology that can develop due to excessive noise exposure is hearing impairment. Therefore, occupational physicians rarely view VAD symptomatology as caused by excessive noise exposure. In fact, given the plethora of complaints associated with VAD (see Table 3), oftentimes physicians regard the patient as a malingerer or hypochondriac (Castelo Branco and Rodriguez Lopez, 1999a), especially since routine medical tests (e.g., blood chemistry analysis, EKG and EEG) do not corroborate the existence of any pathology. One of the reasons for this is that the majority of medical diagnostic tests are based on biochemical, and not biomechanical, pathways (see below). There are dire consequences for the patients, as have been candidly exposed by a Scotsman, who was employed as a motorman, and developed VAD (Arnot, 2003).

In the case of occupational exposure to ILFN, workers can develop disabilities requiring early retirement (Castelo Branco et al., 1998b). Usually ILFN-rich environments are associated with machinery that, in an ever-developing technological world, often becomes obsolete within a few years time. At present, many individuals who have developed VAD due to occupational exposures cannot prove that they have been exposed to ILFN because noise assessments do not take ILFN into account (as described above), and many of the ILFN sources have been retired.

5. VAD in light of mechanobiology

The establishment of VAD has been problematic because of several, non-typical situations that seem to defy conventional medical concepts. For example, the production of collagen, in the absence of an inflammatory process, is consistently seen in the blood and lymphatic vessel walls (Castelo Branco et al., 1999b; Reis Ferreira et al., 2003b,c; Monteiro et al., 2004a), pericardium (Castelo Branco et al., 1999b, 2003c), trachea (Reis Ferreira et al., 2003b), and lung and pleura (Reis Ferreira et al., 2003c) of VAD patients. It is also observed in the respiratory tract (Castelo Branco et al., 2003a), kidney (Castelo Branco et al., 2005d), blood and lymphatic vessels (Martins dos Santos et al., 2002, 2004, respectively) of ILFN-exposed animals.

Much of the data collected on VAD and ILFN-exposed biological tissues has been in the form of ultrastructure micrographs, obtained with scanning (SEM) and transmission (TEM) electron microscopy. The following sections will describe the anatomical findings in VAD patients' pericardia, and in the respiratory tract and cochlea of ILFN-exposed rats, based on information obtained through histological and ultrastructural studies. The implications within the context of mechanobiology will be discussed.

5.1. The pericardium

The pericardium is a fibrous sac that encases the heart, with the purpose of maintaining it in its normal position. External forces, due to respiration or changes in body posture, are absorbed by the pericardium so as to keep the heart and its cardiac rhythm intact. Consisting of three tissue layers—mesothelium, fibrosa and epipericardium—the pericardium is a highly organized mass of connective tissue, with a predominance of

collagen fibers arranged in accordion-like bundles. Elastic fibers, much less numerous than collagen fibers, intersect the collagen bundles at right angles. This anatomical arrangement taken together with the viscoelastic properties of both collagen and elastin, provide the pericardium with the mechanical capability of protecting the integrity of the cardiac cycle. The thickness of normal parietal leaflet of the pericardium is <0.5 mm (Shabetai, 1994). The mesothelium is in direct contact with the pericardial sac, and is formed by a one-layer thick sheet of mesothelial (cuboidal) cell (MC). Anchoring junctions interconnect MC among themselves, through their cytoskeletal fibers—microfilbules—interconnected through desmosomes (see Table 1). Microtubules do not rupture when stretched, can withstand larger stresses and strains than actin filaments, and are crucial to maintain cellular integrity.

Abnormally thickened pericardia were first observed by this team in autopsy (Castelo Branco, 1999b), and later confirmed through echocardiography (Arzuaga et al., 1999; Murcinjak et al., 1999; Torres et al., 2001). No inflammatory process was present, no cardiac dysfunction was identified and, thus, pericarditis is not an issue in VAD patients. The strange feature was that despite the extraordinary enlargement, no diastolic impairment was observed. EKGs of VAD patients were normal, as were the cardiac functional parameters assessed through echocardiography. Simultaneously, echo-imaging did not have a 1–1 correspondence with anatomical structures, thus, it became important to understand what was occurring at the anatomical level.

Since one of the consequences of ILFN exposure is thickening of blood vessel walls (Castelo Branco, 1999b; Castelo Branco et al., 1996, 1999b, 2003c; Reis Ferreira et al., 2003b,c) the recommendation for cardiac bypass surgery by other physicians is not uncommon among VAD patients. Hence, it was possible, with Hospital Ethics Committee approval and patients' fully informed consent, to study pericardial fragments of VAD patients (Castelo Branco et al., 1996, 1999b, 2003b). Pericardial thickening was confirmed anatomically, and a possible reason for the lack of diastolic dysfunction was uncovered (see Fig. 2).

When electron microscopy was used to examine these pericardial fragments, an unusual amount of cellular death was observed. This peculiar type of cellular death was related to the mechanical bursting of cells, with images of seemingly live organelles outside of the burst cytoplasmic membrane (Figs. 3 and 5). Cellular debris

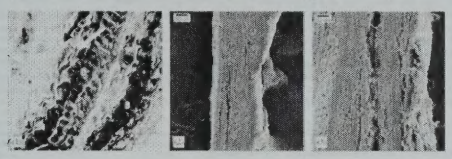

Fig. 2. (I) Light microscopy (100 ×). VAD patient pericardium, with pericardial sac on right. Five (instead of the normal three) layers are identifiable: (A) mesothelial, (B) internal fibrosa, (C) loose tissue, (D) external fibrosa, and (E) epipericardium. The loose tissue is rich in vessels. No inflammatory cellularity was identified in any of the five layers. In both fibrosa layers, wavy collagen bundles are visible. However the wave length of fibers in layer B (internal fibrosa) is smaller than that in layer D (external fibrosa). Taking together the increased amount of collagen bundles, in wavy, accordion-like arrangements, with different orientations in relation to each other, and with more than one elastic fiber accompanying the bundles at seemingly perpendicular angles (seen through electron microscopy, not shown), seems to suggest a pneumatic-like structure, designed to absorb abnormally large external forces. Similarly, this functional arrangement also explains why there is no diastolic dysfunction, despite the thickened pericardial walls. (2) SEM of non-VAD patient pericardium. Normal three layers are visible: mesothelium (white arrow), fibrosa (black arrow) and epipericardium. (3) SEM of VAD patient pericardium. Fibrosa has split into two halves (arrows) that sandwich a newly formed layer of loose tissue (L). Note that the scale in both (2) and (3) is the same. The wavy form of collagen bundles is a mechanically energy efficient method to deal with the movement that the fibrosa must constantly undergo to follow the rhythm of the cardiac cycle. Similar to an accordion, collagen bundles will extend and contract in diastole and systole, respectively. However, during an episode of sudden and violent tachycardia (common in VAD patients), this rhythm can be greatly increased (up to 200 beats per minute, in a matter of seconds) and the mechanical stress imposed on the MC monolayer may threaten its structural integrity. One of the functions of the loose tissue layer must certainly be blood and nutrient supply to this much larger organ.

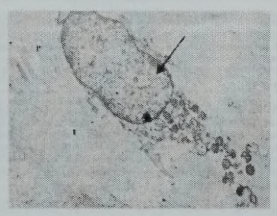

Fig. 3. (TEM) VAD patient parietal pericardium. Deep within the internal fibrosa layer: a burst myofibroblast near a small elastic fiber surrounded by abnormally abundant collagen bundles. Seemingly live organelles are outside the membrane (4000 ×).

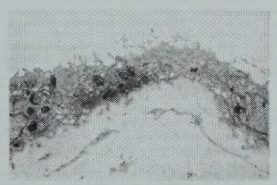

Fig. 4. (TEM) VAD patient pericardial fragment. Pericardial sac (P). Unusual number of cell–cell connections (arrow). Interdigitations (I) linking the MC layer with the subserosal basal layer, through structures reminiscent of anti-seismic constructions (2000 ×).

was seen in all layers and in the vast majority of the images (Fig. 5). Individual, older MC were seen protruding into the pericardial sac, in a process that resembled surface extrusion of that cell (Fig. 6). Discontinuities in MC surface (in direct contact with the pericardial sac) (Fig. 5), with seemingly live organelles spewing into the pericardial sac (Fig. 6) were observed. Desmosomes, which laterally attach adjacent MC (Table 1), were more numerous than would be expected (Fig. 4). The lack of cellular anchoring junctions between MC and the subserosal basal layer (usually accomplished through hemidesmosomes, see Table 1) seems to be replaced by interdigitations whose form is reminiscent of anti-seismic constructions (Fig. 4). MC morphology varied in accordance with the contraction wave of the cardiac rhythm (Castelo Branco et al., 1999b, 2005).

VAD patients often suffer sudden and violent tachycardia, and sudden peaks of increased arterial blood pressure (Castelo Branco, 1999a). This implies a violent and sudden kinetic changes in the cardiac (and pericardial) rhythm. During repeated, VAD-related tachycardia and hypertensive episodes, MC cells become enormously strained, and maintaining structural integrity of the MC monolayer might become an issue. Older

MC cells may have insufficient tensile strength to undergo these violent tachycardia movements, and their extrusion (Fig. 6) from the mesothelium monolayer of cells may be an attempt to maintain structural integrity. The formation of gaps near these older MC cells (Figs. 5 and 6) seems to be an integral part of this extrusion process. The anchoring junctions between the mesothelium and its ECM subliayer seem to have been replaced with MC cytoplasmic interdigitations that dig deep into the ECM sub-layer (Fig. 4). This anchoring structure is not unlike modern anti-seismic constructions, where building blocks fit into each other like pieces in a vertical jigsaw puzzle, providing increased plasticity, and allowing the absorption of large mechanical forces without rupturing.

The existence of such a large amount of cellular debris has been linked to a working hypothesis. The cellular debris seen in VAD patients' pericardial layers can be related to the appearance of auto-immune diseases in ILFN-exposed individuals. Seemingly live organelles that exist outside the cellular membrane envelope (Figs. 3 and 5) will not be identified by the immune system. This could trigger auto-immune disorders. No inflammatory process is tied to the removal of debris. The only visible features are an increased amount of macrophages and neovascularization, with particular relevance to the lymphatic vessels, where the drainage of debris seems to occur.

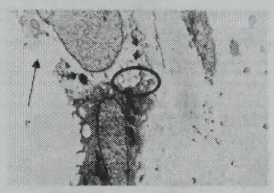

Fig. 5. (TEM) Pericardial sac (P), collagen bundles (C), cellular debris (×). Discontinuous membrane (arrow), partial lost of cytoplasm. Gaps seen near MC (circle) (3000 ×).

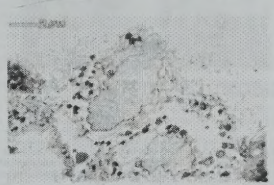

Fig. 6. (TEM) Mesothelial layer with older mesothelial cell (×) in the process of extrusion into the pericardial sac, and with large gaps on either side.

5.2. Actin-based structures—brush cell (BC) microvilli and cochlear cilia

BC exist in the respiratory and gastrointestinal tracts. BC possess microvilli uniformly distributed over the apical surface which is known to play a role in increasing absorption surface area. The function and existence of the respiratory BC in humans is largely unknown. In the rat respiratory tract, BC are surrounded by a ring of secretory cells (SC) (Fig. 7) (Castelo Branco et al., 2003e). In ILFN-exposed rodents, microvilli clustered together and, with increasing exposure time, became fused (Fig. 8) (Castelo Branco et al., 2003a, f, g). Cochlear stereocilia also appeared fused in ILFN-exposed rats, both among themselves as well as with the upper tectorial membrane (Figs. 9 and 10) (Alves-Pereira and Castelo Branco, 2003a).

Why BC microvilli respond to prolonged ILFN stress by fusing is unknown. However, the fact that actin filaments can form both rigid (but flexible) bundles as well as gel-like networks, taken together with the fact that motor proteins connect the actin filaments core to the plasma membrane, microvilli fusion does not seem to be such a remote possibility, given the right triggering events.

If fusion of cochlea stereocilia, as a response to prolonged ILFN exposure, also occurs in humans, then this may explain the unusual auditory complaints of VAD patients. Common auditory complaints of VAD patients include "hearing too much" and "not being able to stand any type of noise, not even television or music". However, their audiograms only present hearing losses within the lower frequency bands (250 and 500 Hz), and their tympanograms are normal (Castelo Branco, 1999a). If fused among themselves and to the tectorial membrane, cilia cannot freely vibrate as is intended when the sound pressure wave is transduced within the cochlea. In fact, by becoming a rigid structure, any attempt at vibrating them might, understandably, produce discomfort. How closely related this phenomenon is to the concept of "annoyance" is still unclear, however a relationship is clearly suggested, especially since annoyance has already been specifically associated with the presence of ILFN (Persson-Waye and Rylander, 2001). In ongoing studies, fusion of actin-based structures in ILFN-exposed rodents has also been observed in the duodenum (Fonseca et al., 2005).

Fig. 7. (SEM) Non-exposed rat bronchial epithelium. The BC, in the center of the image, exhibits a tuft of microvilli that are individually identifiable, uniformly distributed, and sprouting upward into the airway. Surrounding the BC are SC with microvilli of different sizes. Tufts of cilia featuring vesicles are also visible. No cleaned, shaggy or wilted cilia are visible. No edema is present.

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Fig. 8. (SEM) Rat bronchial epithelium exposed to 2160 h of continuous ILFN. A BC is in the centre of the image. Its microvilli are not sprouting upward and, instead, have fused, forming a central fasciculation that seems to be spreading outward. The prominent SC that surround the BC are swollen, forming deep valleys at the intercellular junctions. SC microvilli are very irregular. Ciliary vesicles are visible.

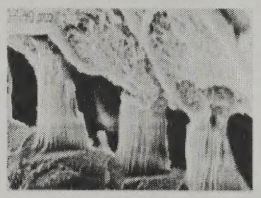

Fig. 9. (SEM) Rat cochlear stereocilia exposed to 4399 h of occupationally simulated ILFN. Cochlear stereocilia are fused amongst themselves and with the upper sectorial membrane.

5.3. Other considerations

Given the data obtained to date, the same type of analysis could be made of ILFN-exposed rat kidney glomeruli (Castelo Branco et al., 2003d; Martins dos Santos et al., 2005), or of rat tracheal epithelia (Castelo Branco et al., 2003a, f, g), or of VAD patients bronchoscopic biopsy results (Monteiro et al., 2004; Reis Ferreira et al., 2006), or of VAD patients vocal abnormalities (Mendes et al., 2005, 2006). The behaviour of respiratory tract ciliary populations is of particular interest in that they are composed of tubulin, they are anchored to the CSK actin cortex and, with ILFN exposure, they appear clipped, sheared and/or shaggy

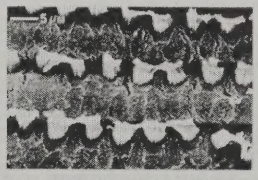

Fig. 10. (SEM) Rat cochlear stereocilia exposed to 4399 h of occupationally simulated ILFN. Cochlear stereocilia after removal of the tectorial membrane, portions of which remain fused to the stereocilia, forming bridges between adjacent cells.

(Alves-Pereira et al., 2003c). Pericardial cilia was also non-existent in VAD patients (Castelo Branco et al., 1999b). The suspicion that the tensegrity model of the cell could explain the findings in ILFN-induced biological structures was hinted at in 1999 (Alves-Pereira) and has since been the object of separate study and independent publications (Alves-Pereira and Castelo Branco, 2003a; Alves-Pereira et al., 2005b, d, 2004c).

Most medical diagnostic procedures are not based on mechano-biological features of disease. Hence, what is analysed, quantified or tested are usually parameters that depend on biochemical pathways. It cannot, therefore, be surprising that VAD present normal routine tests, such as blood chemistry analysis, EKG, and EEG, for example. With echo-imaging, where structural components can be observed, ILFN-induced pathology can be identified. With light and electron microscopy studies, morphofunctional changes can, again, be identified. However, conventional medical tests only become significantly altered in later, and irreversible, stages of VAD (see Table 3). With the tensegrity model of the cell, new avenues of research open up in the area of biochemically based tests from which biomechanical pathology can be extrapolated.

Pharmacological intervention in VAD is several years (and many Euros) away from becoming a reality. However, given that VAD is a mechanotransduction disease *par excellence* it now becomes clear where this intervention must focus: on the cellular signalling processes directly related to mechanotransduction.

6. Conclusions

ILFN is neglected as an agent of disease, and mechanotransduction is underestimated as an integral part of cellular signaling. Since VAD is caused by ILFN and explained through mechanotransduction pathways, it is not surprising that it is taking so long for the medical and scientific community to understand its existence. However, with knowledge comes responsibility, and the time has now come to take a more active position against needless suffering. The following recommendations are proposed.

6.1. Noise assessment

Hearing impairment is still a major issue within the EU and other countries, thus ceasing to perform measurements with dBA units is not a logical course of action. However, ILFN-rich environments need to be taken into account. Hence, it is proposed that *all* noise measurements be accompanied by a 1/3 octave band analysis, with no weighting (in dBLin), and down to the lowest limiting frequency permitted by the equipment at hand. If spectral analysis is not possible, then at least dBC and/or dBLin Leq measurements should be performed. In this way, not only is the acoustical environment documented for future legal and forensic purposes, but the adequate protection and prevention measures can be taken if it is known how much, and what kind, of ILFN is present in the environment.

The same principle applies to biomedical studies, where ILFN is a possible contaminant. This is particularly true for animal studies where laboratories are kept in building basements, along with HVAC systems and elevator machinery. With human populations, it is important to obtain ILFN-exposure histories, since the effects of ILFN are cumulative (Castelo Branco et al., 1999d) and occur independent of whether the exposure was occupational, residential or leisurely. For example, an office worker may have no immediate exposure to noise on-the-job, but may live next to a bus terminal.

Control populations are especially targeted for comprehensive surveys of previous ILFN-exposure histories because, by definition, they *must not* have prior exposure to ILFN; foetal and leisurely exposures to ILFN must be included in the individual's prior history of ILFN exposure (Castelo Branco et al., 2003a, g; Azuaje et al., 2004). The inadequate selection of control populations has already led to wasteful uses of resources and, of course, misleading results (ATSDR, 2001). Given the ubiquitous nature of ILFN, control populations with zero prior ILFN exposure are extremely difficult to gather. Thus, it could be feasible to undertake studies where the bio-effects of ILFN-exposed populations are compared, but only if their acoustical exposures are sufficiently well documented, in terms of exposure times and acoustical spectra.

6.2. Dosimetry

Adequate dosimetry of ILFN will be very difficult to achieve until science considers the acoustical spectrum as analogous to the electromagnetic spectrum, i.e., different frequencies have different effects on the different tissues. Thus, breaking the flowery acoustical spectrum into infrasound versus audible frequencies is much too rudimentary.

It is proposed that the ILFN (0–500 Hz) portion of the acoustical spectrum be divided into the sub-categories listed in Table 4. Biological tissue is very sensitive to lower frequencies, below 100 Hz. Specific frequencies have been known to have a deleterious impact on specific biological tissue (e.g., Nekhoroshev and Glinchikov, 1991, 1992; Svigovsyi and Glinchikov, 1987; Sidorenko et al., 1988), and a 2 Hz exposure can produce different effects than an 8 Hz exposure (Nekhoroshev and Glinchikov, 1991, 1992). Dividing the acoustical spectrum in sub-categories would eventually force biosclentists to specify the acoustical energy within each specific sub-category.

One of the most immediate problems with adequately measuring ILFN is the lack of readily available (and relatively inexpensive) instrumentation. As is well known, much of the monitoring equipment designed to assess physical agents is geared toward assessing the parameters that have been established by legislation. Thus, it is difficult (or much too expensive) to acquire the instrumentation that could adequately measure how long the acoustical energy remains at a certain dB level, for each 1/3 octave band. This would be an ideal parameter for assessing ILFN-induced pathology.

Table 4
Proposed subdivisions of the lower portion (0–500 Hz) of acoustical spectrum, by 1/3 octave bands

Sub-category	1/3 octave bands (Hz)[a]	Observations
A	0–6.3	6.3 Hz is often the lower limiting frequency of standard noise measuring equipment software
B	8–12.5	Unusual behaviour in the frequencies of 8, 10 and 12.5 Hz has been detected, in residential, occupational and natural environments (unpublished results)
C	16–25	Overlapping the conventional threshold for human hearing (20 Hz)
D	31.5–63	Where many machines emit noise, includes the 50 Hz associated with high-voltage electrical distribution
E	63–160	Resonance of the ossia
F	200–500	Upper limit, with 250 Hz and 500 Hz already included in audiograms evaluations

[a]The 1/3 octave band analysis divides the acoustical spectrum into frequency bands, referred to by their central frequency. Thus, when measuring in 1/3 octave bands, values are obtained for the 1/3 octave frequency bands whose central frequency is 6.3, 8, 10, 12.5, 16, 20, 25, 31.5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400 and 500 Hz (see Fig. 1). Hence, in this Table, the apparent discontinuities in the 1/3 Octave Bands column are due to the way in which science segments the acoustical spectrum.

With animal models, some form of ILFN-exposure dosimetry has already been achieved. It is known that after a 48-h continuous exposure to ILFN, it is necessary 7 days for full recovery (Castelo Branco et al., 2003d). However, large-scale epidemiological studies are still lacking, mostly due to the difficulty of selecting adequate control populations, and funding.

6.3. Pharmacological intervention

With the integration of the tensegrity cellular model, VAD can now be viewed as a mechanotransduction disease *par excellence*. As such, new avenues of research have opened up regarding the possibility of pharmacological intervention. Since actin- and tubulin-based structures seem to be the most affected, it would make sense to focus on these biomechanical elements in order to avoid irreversible damage to individuals who *must* remain in ILFN environments for extended periods of time, such as ship and submarine workers, offshore oil and gas platforms workers, human activity onboard spacecraft, and the general population who is environmentally exposed to ILFN in the home.

6.4. Diagnosing VAD

For the purposes of an informal diagnosis, an echocardiogram to evaluate pericardial and cardiac valve thickening is essential to establish a VAD diagnosis because pericardial thickening with no diastolic dysfunction, and in the absence of an inflammatory process is a specific sign of VAD (Hoit, 2000). However, given the limitations of echo-imaging procedures (discussed above) the echocardiogram is insufficient for legal and forensic purposes. Thus, if legal proof of VAD is required, then a more invasive procedure is necessary – the bronchoscopic examination (Reis Ferreira et al., 2006).

Other complementary diagnostic tests include brainstem auditory evoked potentials and cognitive evoked potentials (P300), brain magnetic resonance imaging, PCO_2 rebreathing test, blood coagulation factors and a thorough neurological examination.

Suspicion of VAD should arise if the patient exhibits one or more of the following complaints:

- "I hear too much. I'm very sensitive to noise. I can't stand any type of noise. Noise drives me crazy. Whenever there's a loud noise, all I feel like doing is screaming";
- "I wake up tired. It's not that I don't sleep enough hours, it just seems like I don't rest during my sleep";
- "Sometimes, while in a shopping mall or a restaurant, I feel like I can't breath, like I must get out of there or else";
- "I have a lot of heart palpitations. Sometimes it feels like my heart is going to leap out of my chest"; and
- "I have this cough, and I don't smoke. My throat is constantly irritated and I get hoarse for no reason. The over-the-counter medication doesn't do anything".

Or if the patient enters with one of the following diagnosis:

- Late-onset epilepsy;
- Balance disorders;
- Migraine;
- Respiratory tract tumour, especially if a non-smoker;
- Recommendation for cardiac bypass surgery; and
- Auto-immune disease, particularly systemic lupus erythematous and vitiligo.

The authors urge physicians to listen to their patients and question them about their noise exposures.

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Valley Fever Connections
Statistics

The epidemic seems to be a warning, for reasons that are not clear, but the marked increase in incidence from the 1980s to 1991 through 1993 is indisputable. What factors may account for this increase? One major consideration is the weather. C. E. Smith observed years ago that the number of cases of coccidioidomycosis was higher in the summer after a rainy winter than after a dry winter. In March 1991, a 5-year drought in California ended with a heavy rainfall. Rainfall was also heavy in the winters of 1992 and 1993. Though the relationship between the weather and the density of C. immitis in the soil may never be understood in detail, the following scenario seems plausible. During drought years, the number of organisms competing with C. immitis decreases. C. immitis does not thrive, but it remains viable though dormant. After heavy rain, the arthroconidia germinate and multiply to a higher density than usual because of the lack of competing organisms. Once the soil dries in the late summer and fall, the arthroconidia become airborne and potentially infectious.

Another reason for the sudden increase in disease incidence might have been the number of susceptible persons in the disease-endemic area. The number may have been the result of both increased migration of susceptible persons and decreased immunity in the indigenous population. Immunity comes from prior infection and is manifest as a positive coccidioidin skin test. In almost all cases, coccidioidomycosis confers lifelong immunity. As a result of years of low incidence, the number of nonimmune persons may have increased, as evidenced by the decrease in prevalence of positive coccidioidin skin tests among local high school students. In 1939, 50% to 60% of high school students in the San Joaquin Valley had positive skin tests, but in the 1980s only 3% to 5% of high school students had positive skin tests (T. Larwood, pers. comm.). Given the historical data, this estimate seems low, but another study also found a low prevalence. In 1985, workers in Tucson estimated that 30% of a random sample of persons in a Hispanic neighborhood had positive skin tests . In addition to the drought, irrigation of fields, the increasing amount of land under cultivation, and a decrease in indoor dust due to the widespread use of air conditioning may also have played a role in the relatively low incidence of infections in the 1980s.

Arizona Department of Health Services

Infectious Disease Epidemiology - Valley Fever in Arizona

The reported number of cases of Valley Fever in Arizona has been increasing since it became laboratory-reportable in 1997. In 2005 there were 3515 cases reported; only 958 cases were reported in 1997. Between January and April 2006, ADHS received over 2,000 case reports of Valley Fever. This is more than three times the five-year average for these months.

The highest rates of infection in Arizona occur in Maricopa, Pima and Pinal counties, and the peak seasons occur from June through August and from October through November.

CDC - Reemerging Infectious Disease

The risk for disseminated coccidioidomycosis is much higher among some ethnic groups, particularly African-Americans and Filipinos. In these ethnic groups, the risk for disseminated coccidioidomycosis is tenfold that of the general population . Presumably, a gene (or genes) that increases susceptibility to infection is more prevalent in these ethnic groups than in the general population. Such a resistance gene has been identified in mice, but not yet in humans. The mechanism by which the resistance genes affect the course of the disease in mice is not clear. Pregnant women and the immunosuppressed are also at high risk for developing disseminated disease (Figure 3). One study demonstrated that the growth rate of spherules was influenced by human sex hormones, which may partially account for the increased risk of disseminated disease in pregnancy. Pregnancy also redirects the immune response toward humoral (TH2) immunity and away from delayed hypersensitivity (TH1), which may influence resolution of coccidioidomycosis. Generalized suppression of cell mediated immunity also increases the risk of disseminated disease. Coccidioidomycosis is particularly severe in patients with organ transplants or AIDS.

Coccidioidomycosis in Solid Organ

Coccidioidomycosis is an endemic fungal infection of the southwestern United States. Normally a self-limited infection in healthy hosts, coccidioidomycosis can become a serious complication in patients who have had solid organ transplantation. Among patients whose solid organ transplantation was complicated by coccidioidomycosis, the infection has a variety of clinical presentations. Disseminated disease is common and has substantial morbidity. Patients at risk for coccidioidal infection should be identified so that antifungal prophylactic therapy can be initiated. Treatment options include amphotericin B or azoles. Secondary prophylaxis is recommended because relapse is frequent.

Karger Report - Viral Meningitis (.pdf)

Viral Meningitis-Associated Hospitalizations in the United States, 1988-1999; We used the National Hospital Discharge Survey and the Nationwide Inpatient Sample of the Health Care Cost and Utilization Project to estimate disease burden associated with viral meningitis hospitalizations in the United States. During 1988-1999, viral meningitis accounted for an estimated 434,000 hospitalizations (annual average, 36,000; average annual hospitalization rate, 14/100,000), and 2.1 million hospital days (annual average, 175,000). The estimated mean charge for viral meningitis-associated hospitalization during 1993-1997 varied between USD 6,562 and 8,313, resulting in annual estimated hospitalization costs between USD 234 and 310 million and a total estimated cost of nearly USD 1.3 billion for the 5-year period. In summary, viral meningitis remains an important cause of morbidity and financial burden and merits efforts to improve diagnostic, treatment, and prevention options.

©2006 Valley-Fever.org All rights reserved Microbiology, Mycology, Fungal Resources Valley Fever, Coccidiomycosis, Valley Fever Treatment, Coccidiomycosis, Valley Fever Connections

NPS study: moderate noise can have major impacts on animals

An ongoing research project from the National Park Service Natural Sounds Program is about to publish a groundbreaking paper that outlines the many ways that even moderate increases in human background noise can create major impacts on animals. The study proposes a new metric for use in bioacoustics research, the "effective listening area."

December 12, 2009 in The Acoustic Ecology Institute

An ongoing research project from the National Park Service Natural Sounds Program is about to publish a groundbreaking paper that outlines the many ways that even moderate increases in human background noise can create major impacts on animals. The study proposes a new metric for use in bioacoustics research, the "effective listening area." This is the area over which animals can communicate with each other, or hear other animals' calls or movements; as might be expected, animals focus especially on listening for sounds at the very edges of audibility, so that even a small increase in background noise (from a road, wind farm, or regular passing of airplanes) can drown out sounds that need to be heard. The authors note analyses of transportation noise impacts often assert that a 3dB increase in noise - a barely perceptual change - has "negligible" effects, whereas in fact this increased noise reduces the listening area of animals by 30%. A 10dB increase in background noise (likely within a few hundred meters of a road or wind farm, or as a private plane passes nearby) reduces listening area by 90%.

In addition to introducing this important new metric, the paper provides a good overview of previous research that has addressed the impacts of moderate noise on various animals, including bats, antelope, squirrels, and birds. The paper will be published next year, though an "in press" version is available for download. A recent BBC article also covered this important new work. A full detailed lay summary of this paper, as previously published on AI-Ts science research page, appears below the fold:

Animal listening area and alerting distance reduced substantially by moderate human noise. Barber, Crooks, Fristrup. The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology and Evolution; 2010.

This is one of the most important and interesting papers published this year. It emerges from the partnership between the National Park Service's Natural Sounds Program and researchers at Colorado State University, who have been working together for several years to create metrics that are more useful for assessing the biological impacts of moderate human noise on wildlife. The assessments presented here, along with the paper's review of recent studies documenting changes in foraging, anti-predator behavior, reproductive success, density and community structure in response to noise, form the basis for a much more cogent assessment of noise impacts on wildlife.

The focus of this research is the ways that moderate increases in background noise can affect animals. The authors note that both air and road traffic in the US has tripled in recent decades; even in National Parks, noise is audible 25% of the time in more than half of sites assessed. Over 80% of US land area is close enough to roads for some low-frequency masking to occur, with passing trucks and motorcycles increasing the sound levels at 1km to 40dB(A).

One of the new proposed metrics is the effective "listening area." Changes in listening area has impacts involving both communication and what the authors term "adventitious" sounds (sound made largely by movement, which are important in predator/prey awareness). For predators, the listening area is the area over which they might hear the rustling of their prey, and for prey, it is the area in which they are alerted to approaching predators, whether wingbeats or footsteps; in each case, the most important sounds are those right at the edge of audibility. Social groups rely on hearing each other's alarm calls or songs inviting mating; reduced listening areas for these calls result in effectively reducing the number of individuals in any given communication network. Each animal has its own auditory acuity, so can hear at different distances; but for all animals, increasing background noise will reduce their natural listening area in predictable ways. The authors note analyses of transportation noise impacts often assert that a 3dB increase in noise - a barely perceptual change - has "negligible" effects, whereas in fact this increased noise reduces the listening area of animals by 30%. A 10dB increase in background noise (Ed. note: likely within a few hundred meters of a road or as a private plane passes nearby) reduces listening area by 90%.

Throughout, the authors stress the difficulties in separating noise-related effects of traffic from other related forces, such as habitat fragmentation or threat responses; there is also a fascinating short section citing studies showing behavioral changes in response to quiet recreation, sometimes even more dramatic than those caused by vehicles. Though only a few studies have directly addressed this ambiguity, many studies cited here provide strong indications that acoustic masking is a significant factor in behavioral changes near roads. Among the findings that caught my eye/ear:

• Masking affects not only audibility, but understanding: "thresholds for discrimination between calls of the same species were consistently higher than were detection thresholds for the same calls." Not surprising, but easy to forget; background sound often obscures the words being said, though we can still hear the voice.

• Bats that listen for ground movements of their prey hunt more in quiet areas than noisy ones; similarly insect-eating birds are more likely to avoid noisy areas than other birds.

• Masking can also make it more difficult for animals to tell what direction a call (such as a mating call) is coming from

• Pronghorn antelope showed a marked shift in proportion of time spent foraging and in vigilance (looking around) when closer to roads: foraging dropped from 45% of the time to 35%, while vigilance increased from 40% to over 50%.

• Two key studies of increased vigilance in clearly noise-triggered contexts: Ground squirrels showed a marked increase in vigilance behavior when hearing squirrel alarm calls at a site in a wind farm than in a quiet site (including a slightly less "relaxed" post-vigilance baseline state), and a lab study with chaffinches found that the mean time spent pecking (eating) between times scanning the area decreased when noise was introduced.

The authors conclude by stressing: "Chronic noise exposure is widespread.

Taken individually, many of the papers cited here offer suggestive but inconclusive evidence that masking is substantially alter- ing many ecosystems. Taken collectively, the preponderance of evidence argues for immediate action to manage noise in protected natural areas....The costs of noise must be understood in relation to other anthropogenic forces, to ensure effective mitigation and efficient realization of environmental goals.

Noise pollution exacerbates the problems posed by habitat fragmentation and wildlife responses to human presence; therefore, highly fragmented or heavily visited locations are priority candidates for noise management. Noise management might also offer a relatively rapid tool to improve the resilience of protected lands to some of the stresses imposed by climate change."

Web link: http://naturalsounds.org/archives/573"

http://www.wildlifenews.org/news/24084

Frontiers in Ecology and the Environment

The ecology of dust

Jason P Field, Jayne Belnap, David D Breshears, Jason C Neff, Gregory S Okin, Jeffrey J Whicker, Thomas H Painter, Sujith Ravi, Marith C Reheis, and Richard L Reynolds

Front Ecol Environ 2009; doi:10.1890/090050

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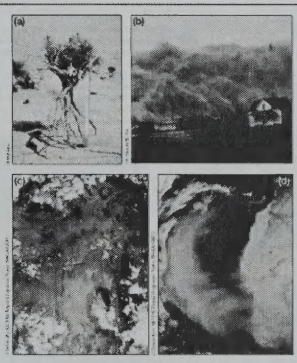

Figure 1. (a) Individual plant scale: shrub with exposed roots following the aftermath of a San Joaquin Valley dust storm in December 1977 (by Lloyd Sells; dust storm approaching Stratford, Texas, April 18, 1935; (c) Regional scale: dust storm (arrowed) on July 23, 2003, migrating in the western part of Utah and blowing northeastward over Great Salt Lake. (d) Global scale: dust emanating over the Atlantic Ocean, thence Key off the west coast of northern Africa on March 2, 2003.

land-use intensification (Okin et al. 2006) could amplify dust emissions from drylands and pose major environmental challenges for land managers and policymakers.

A wind erosion primer

Wind transports soil material through three mechanisms (Figure 2) that are roughly distinguished based on the soil particle diameter (these categories overlap): suspension for soil particle diameters < 500 µm, saltation for diameters ranging from 50–500 µm, and suspension for diameters < 50 µm (Bagnold 1941; Tatarko 2001; Gillette and Middleton 2006). All three processes redistribute soil and associated nutrients and organic material at different spatial scales (Field et al. in press). Wind-driven surface creep and saltating particles dominate the mass movement of soil on a local scale (less than several meters; Sterk and Zobeck 2006). In contrast, suspended dust particles can be transported over long distances and can be moved at regional, continental, and even global scales (Chadwick et al. 1999; Prospero et al. 2002; Gwalde and Middleton 2006). Most of the horizontal aeolian sediment transport occurs close to the soil surface, decreasing sharply with height (Okin et al. 2006).

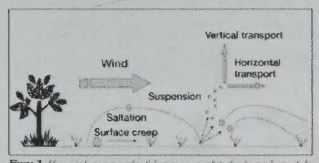

Figure 2. How wind erosion works. Saltation occurs when the shear velocity of the wind exceeds the threshold shear velocity of the soil; suspension of dust-size particles occurs when saltating particles wind-blast the soil surface, overcoming the strong interparticle forces between the particles.

A small fraction of this flux can become suspended and thus be available for long-distance dust transport, as reflected in a vertical flux that is frequently related to horizontal flux (Gillette et al. 1997). Because soil nutrients (eg nitrogen, phosphorus) and organic matter are often associated with smaller soil particles, soil fertility in dust-source areas becomes depleted while sink areas are concomitantly enriched (Lu et al. 2003).

Wind erosion rates and dust emissions at a specific location are influenced by various factors, such as macroscale wind gradients and atmospheric relative humidity (Tsoar et al. 2002). Wind speed is related to the

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The ecology of dust

Jason P Field[1*], Jayne Belnap[2], David D Breshears[3,4], Jason C Neff[5], Gregory S Okin[6], Jeffrey J Whicker[4], Thomas H Painter[7], Sujith Ravi[8], Marith C Reheis[9], and Richard L Reynolds[9]

Wind erosion and associated dust emissions play a fundamental role in many ecological processes and provide important biogeochemical connectivity at scales from individual plants up to the entire globe. Yet, most ecological studies do not explicitly consider dust-driven processes, perhaps because most relevant research on aeolian (wind-driven) processes has been presented in a geosciences rather than an ecological context. To bridge this disciplinary gap, we provide a general overview of the ecological importance of dust, examine complex interactions between wind erosion and ecosystem dynamics from the scale of plants and surrounding space to regional and global scales, and highlight specific examples of how disturbance affects these interactions and their consequences. It is likely that changes in climate and intensification of land use will lead to increased dust production from many drylands. To address these issues, environmental scientists, land managers, and policy makers need to consider wind erosion and dust emission more explicitly in resource management decisions.

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For many scientists, the only dust they think about is the thin film of material that accumulates on their computer monitors on a regular basis. However, dust has enormous relevance to a wide range of ecological processes and environmental management challenges. Dust is fine particulate material that is removed from the land surface by wind erosion and is small enough to be suspended in the atmosphere (Bagnold 1941; Tatarko 2001). Dust emissions vary with climate, as shown by paleo-studies (eg Clark et al. 2007), and also with land use. Perhaps the most notable example of how ecologically important dust can be is the Dust Bowl era of the 1930s in the American Great Plains, which is considered by many experts to be one of the most severe environmental catastrophes in the history of the US (eg Peters et al. 2007). The widespread cultivation of marginally arable lands, in conjunction with a severe regional-scale drought during the 1930s, caused substantial increases in wind-driven soil rates, resulting in the degradation of roughly 90 million hectares of land (Lee et al. 1935) and the loss of nearly 850 million metric tons of topsoil in 1935 alone (Schuman 1942; Barnett and Libecap 2004). This large-scale amplification of wind erosion was the result of small fields becoming more exposed and interconnected (Hansen and Libecap 2004), thereby triggering a threshold response (Peters et al. 2007). The devastating effects of the Dust Bowl were felt nationally and resulted in the formation of the Soil Conservation Service in 1935. However, the important ecological lessons of the Dust Bowl have faded with time, and most ecological studies do not explicitly consider the impact of dust flux and wind erosion. Ironically, the former Soil Conservation Service – now the Natural Resources Conservation Service – has shifted most of its focus to water erosion, and has largely abandoned the problem of wind-related erosion (Field et al. in press).

Environmental scientists are increasingly recognizing dust as both a major environmental driver and a source of uncertainty for climate models (Harrison and Ohba 2006; Neff et al. 2008). Wind erosion and dust emission can cause substantial impacts, not only to human health (eg through respiratory problems), but also to basic ecosystem processes, at scales ranging from individual plants or even smaller (Figure 1a) up through local and regional scales (Figure 1b, c) to a global scale (Figure 1d), representing biogeochemical connectivity across continents (Peters et al. 2007; Okin et al. 2009).

Here, we provide a primer on the importance of aeolian (wind-driven) processes associated with wind erosion, as well as an overview of their ecological relevance at scales from plant interspace (the area between as well as below plant canopies) to global, and associated aspects of biogeochemical connectivity. An underlying theme that plays out at many scales is that wind erosion has a highly nonlinear response to disturbances that reduce ground cover below some critical threshold. We discuss how the effects of climate change (Seager et al. 2007) and

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In a nutshell:

- Ecologists and other environmental scientists often overlook the importance of dust and wind-driven processes, yet these processes exert a fundamental influence on biogeochemical and ecological systems
- The importance of these processes crosses scales from individual plants up to global levels
- Because changes in climate and intensification of land use are expected to result in increased dust production and export, land managers, and policy makers need to more explicitly consider and manage dust emission

amount of energy available to move sediment, and much aeolian research focuses on the "threshold friction velocity" wind speed at which particles of a given size under a given set of field conditions begin to detach from the soil surface (Gillette et al. 1996). Atmospheric relative humidity controls soil moisture in the soil surface, especially in arid and semiarid regions during nighttime periods (Ravi et al. 2004), because soil moisture in particles at the soil surface is typically at equilibrium with atmospheric moisture. This is important, because soil moisture influences the interparticle forces that, in turn, influence the threshold velocity, resulting in a robust, but complex relationship between atmospheric relative humidity, particle size, and soil erodibility (Ravi et al. 2004). Wind erosion may be protective with respect to erosion, although few studies have specifically addressed this issue (Field et al. in press). Collectively, these complex relationships need to be considered in terms of their relative role in affecting aeolian processes at all scales.

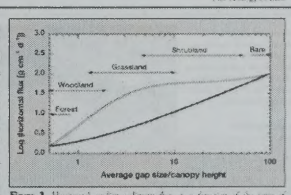

Figure 3. Horizontal aeolian sediment flux as a function of the size of average unvegetated gap size in plant height. The black line delineates how flux could vary in the presence of an undisturbed herbaceous layer for such a situation; the gray line indicates how flux might vary in the presence of a disturbance that removed most of the herbaceous layer. Flux rates are calculated for sediment and conditions at each central New Mexico. Flux rates are calculated for a wind shear velocity of 100 cm s^{-1}, and a smaller loam soil with a threshold shear velocity of 54 cm s^{-1} is assumed. Woodland applies to lands that have a mix of small shrubby trees and open spaces. Adapted from Okin (2008) and Breshears et al. (2009).

Plant-interspace scale

At the plant-interspace scale, which includes the area between as well as beneath individual plants, aeolian transport is major abiotic mechanism for removing material both within and out of environments with discontinuous cover. The continuity of the soil surface, and thus the potential impacts of aeolian processes at the plant-interspace scale, depend on both the ability of the soil surface to resist erosion and the ability of the wind to reach the soil surface. Erosion resistance is determined by the strength of the soil and the presence of surface protectors, such as rocks, plant litter, and physical and biological soil crusts (Gillette et al. 1982; Okin et al. 2006). Rocks and plant litter can be large to be moved by wind, offer the greatest soil protection. Physical soil crusts – created by the binding together of silt and clay particles when wetted and then dried – protect soils, except when crusts are subjected to disturbance. Unless disturbed, these soils have an inherently higher resistance to erosion than soils dominated by coarser sand particles. Biological soil crusts, composed of cyanobacteria, lichens, and mosses, stabilize soils by excreting mucilaginous material that binds soil surface particles together, thereby increasing soil aggregate size and increasing soil resistance to the shearing forces of wind (Belnap and Gillette 1997).

The type, cover, and arrangement of vegetation have the strongest influence on the ability of the wind to reach the soil surface. The particle and dynamic nature of vegetation in dryland regions results in aeolian transport being highly heterogeneous in both space and time. The amount of material that is moved depends on the size of unvegetated gaps upon which the wind can act (vertically excluding rocky or gravelly areas, referred to as desert pavement, and areas covered by physical or biological soil crust) and the height and density of the vegetation, which controls the size of the protected area downwind of individual plants (Breshears et al. 2009). Although surface characteristics are important, the amount of horizontal flux depends largely on the structure of the ecosystem and the degree of connectivity between unvegetated gaps (Okin et al. 2009; Figure 3). Unvegetated areas immediately downwind of vegetation (within 5–15 times the height of an individual plant) are relatively protected from the erosive force of the wind by the plant. In contrast, unvegetated areas further downwind from a plant do not experience the same degree of protection from erosion (Okin 2008). This disparity leads to heterogeneous erosion and the net movement of soil and litter from unvegetated gaps and concentration of these resources beneath plant canopies. Sufficient wind particles are concentrated in protected areas beneath plant canopies, giving rise to coppice dunes in extreme circumstances, such as with environments that have sparse vegetation cover and easily mobile soil. Because saltating material carries most of the mass and momentum, it can have considerable physical effect on existing vegetation, including burial, exposure of belowground plant tissue (pedestalling), abrasion of plant tissue, and leaf stripping. This has been shown to indirectly lead to reduced plant growth and mortality, and to contribute to rapid changes in ecosystem structure (ie initiating a rapid change from grassland to shrubland; Okin et al. 2006).

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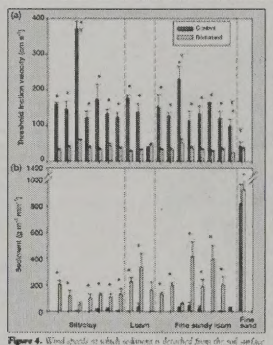

Figure 4. *Wind speeds at which sediment is detached from the soil surface (TAV). Thin, a higher value denotes greater soil stability. (b) The horizontal aeolian sediment flux; thus, a higher value denotes lower soil stability and greater sediment production. Error bars represent + SE. * denotes statistical differences (P < 0.05). "0" indicates that wind speeds generated by the tunnel were unable to dislodge the soil surface in the control soils; thus, reported values are conservative.*

Finer particles moved by wind – including silt- and clay-sized particles – contain most of the cation-exchange capacity, water holding capacity, and fertility of the soil (Goy et al. 2003). Some of these finer particles are trapped by local vegetation (Raupach et al. 2001) and, combined with a similar mechanism for water erosion, contribute to the formation of fertile islands found throughout dryland regions (Schlesinger et al. 1990). In addition, fine granules and associated nutrients are added to soils by sedimentation through gravelly surfaces (Reheis et al. 2009). However, many of these finer soil particles are essentially lost from the local system due to wind erosion (Gillette 1974), resulting in local depletion of soil fertility and water-holding capacity (Li et al. 2007, 2008). The net new depletion of fine particles at the surface may not have immediate impacts on existing vegetation, because the effect is concentrated above the root zone. The implications of this depletion for vegetation establishment, however, are striking, because of the heavy reliance of germinants on soil resources and water in the uppermost soil layers.

Many of the factors that favor wind erosion are, of course, greatly affected by soil surface disturbances. Grazing cattle crush biological and physical soil crusts and decrease vegetative cover (Nash et al. 2004), thereby increasing wind erosion (see Neff et al. 2005). Utility vehicles and military training scenarios also crush vegetation and impact plant-interspace surface characteristics, particularly biological and physical soil crusts (Belnap and Gillette 1997, Buschiazzo et al. 2008, Figure 4). Fire can dramatically increase wind erosion (Whicker et al. 2002, Breshears et al. 2003), although fire may be less generally extensive than grazing and recreational use. Burning vegetation favors by typical rangeland fires) releases different amounts of organic compounds, which in turn, lead to different levels of water repellency in the soil, depending on various factors, such as vegetation type, soil properties, and fire intensity and duration (DeBano 2000). Fire-induced water repellency decreases the stability of interparticle soil-bonding forces by increasing the soil water content at which

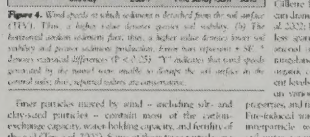

Figure 5. *Primary feedbacks between ecosystem function, wind erosion, and ecosystem structure.*

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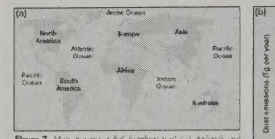

Figure 7. *Map showing global distribution of (a) drylands and (b) their respective dust emissions by region. Tg = teragram. Modified from Tanaka and Chiba (2006).*

(see Prospero et al. 2002). In North America, human land use of semiarid regions for grazing also appears to have increased dust deposition rates in the 20th century, relative to those of the 19th century (McGowan et al. 2001). The human role in dust emission and deposition may be limited at the global scale, but at local to regional scales, dust appears to be mostly a byproduct of human land-use decisions. In this way, humans may be indirectly responsible for potentially large, but poorly understood, perturbations to local, regional, and global hydrologic and biogeochemical cycling.

■ Projections and implications

The future will bring many environmental changes to dryland areas; these will act independently and synergistically to affect dust fluxes at the local, regional, and global scales. Projected climatic changes include a global increase in temperatures (Seager et al. 2007) in concert with a range of future precipitation possibilities for drylands. This could include greater aridity in some areas, but most regions are more likely to experience a small decrease in precipitation. By 2050, increased temperature alone is expected to decrease average soil moisture conditions in the southwestern US (Seager et al. 2007) to levels below those experienced during the most severe droughts of this century, including the Dust Bowl years (Peltier et al. 2005). Such declines in soil moisture will probably result in a reduction in the protective vegetative cover, a slower recovery from disturbance, and an increase in dust emission from exposed soil. Lower soil moisture will also mean drier fuels that burn more readily – additives in the system US are projected to increase substantially in both frequency and intensity (Brown et al. 2008), which will also increase exposed soils and the hydrophobicity of those soils, thus magnifying dust emissions (Whicker et al. 2002, Ravi et al. 2007).

Worldwide, human use of dryland regions, which comprise almost 41% of the terrestrial land surface, is increasing dramatically. Currently, over 2 billion people depend on drylands for habitation and food (MA 2005), and much of the global population growth is occurring in these water-limited landscapes (Reynolds et al. 2007). For example, human populations in southern Arizona and California are expected to grow from 25 million to 38 million over the next 11 years (Pulliam et al. 2003). An increase in human settlement of these landscapes will be accompanied by a further loss in the protective covering of plants, plant litter, and physical and biological soil crusts, thereby amplifying dust emissions from the disturbed surfaces. Offroad recreational activity in southern California has risen from virtually zero in 1965 to almost 10 million user-days in 2005 (Bureau of Land Management BLM's database). It costs drivers $2 km per day, this specific activity alone, in this relatively small region, can generate as much as 2.7 metric tons of dust per year (Duck and Stokell 1976, Forman et al. 2003). The post-exploration era, and development of energy resources (including wind and solar) in dryland regions are also of concern. All of these activities will result in the loss of vegetation and soil surface protection (eg scraping away vegetation for solar farms and oil pads), increased offroad vehicular traffic, pipelines, transmission lines, and greatly increased traffic on existing and heavily established dirt roads. The demand for water is also ever increasing in these regions – demands that result in water diversions or the pumping of water from shallow lakes, often drying them completely (eg Lake Aibi in China; Aral Sea in Uzbekistan; Owens Lake in US), or from shallow aquifers, which may lead to the death of vegetation (Hamdan et al. 2008). These activities can leave vast expanses of soils highly vulnerable to wind erosion. An example of the influence of dust from dry lake sediments on vegetation is provided by Pfadt et al. (1999), who found that dust from playas (dry or ephemeral lake beds), which are rich in nutrients and other nutrients, stimulated the invasion of a playa margin, once ameliorated landscape by weeds (such as *Salsola pestifer*).

The conversion of perennial plant communities to those dominated by annual plants is also increasing glob-

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ing cascading landscape-degradation phenomena caused by local or regional disturbance events (Peters et al. 2007). At the same time, dust emitted by desert regions, particularly those that have experienced substantial disturbance, can have critical consequences for downwind ecosystems.

■ Regional- to global-scale consequences

The regional and global transport of dust plays many fundamental roles in the Earth system. Dust has an important, yet relatively poorly quantified, influence on climate at both regional and global scales. At regional scales, dust can have a substantial effect on the atmospheric radiative balance and the concentration of condensation nuclei, both of which can influence climate variability via effects on surface temperatures and precipitation patterns (Yoshioka et al. 2007). Dust deposited on mountain snowpack can have an indirect effect on climate through the snow albedo feedback (Painter et al. 2007, Stelzer et al. 2009, Figure 6). Dust decreases snow albedo, removing snow cover earlier and revealing a markedly darker land surface that absorbs solar radiation and transfers it to the ground surface. The triggering of earlier and faster snowmelt by dust can potentially result in less total and less late-season water supplies in areas where seasonal water security occurs.

In addition to its effects on climate, dust plays an important role in the control of regional and global biogeochemical cycles and dispersal of pathogens. At the global scale, nutrient additions by dust may have stimulated the productivity of oceanic plankton over glacial time scales, thus accelerating the uptake of atmospheric CO_2 (see Jickells et al. 2005). At the regional scale, there have been several studies examining the impact of dust deposition on terrestrial and aquatic nutrient cycling. In tropical ecosystems with a long legacy of chemical weathering and depletion of soil base cations and phosphorus, dust has been suggested as a major nutrient source. For example, the transport of Saharan dust to the Amazon basin has played an important role in offsetting the losses of hydrologically derived nutrients to leaching (Koren et al. 2006). Similar studies in Hawai'i suggest that dust is responsible for supplying essential plant elements to heavily weathered soils (Chadwick et al. 1999). There is mounting evidence that dust transport and deposition are important to temperate ecosystems as well. Transport of nitrogen, phosphorus, and other nutrients by dust can be substantial (Neff et al. 2008), and the subsequent deposition of these nutrients may influence both terrestrial and aquatic ecosystems. In stable soil surfaces on the Colorado Plateau, dust accumulation in soils has increased the stocks of all macro- and micronutrients, especially phosphorus and magnesium (Reynolds et al. 2006). Long-term dust accumulation can lead to the development of base-rich (concentrated) soils (known as calcisols) in some regions, such as the American Midwest, providing for fertile agriculture (Pye 1987). These diverse studies illustrate that dust is an important and underappreciated component of contemporary biogeochemical cycles.

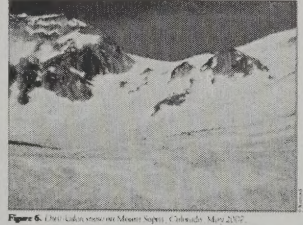

Figure 6. *Dust-laden storm on Mount Sopris, Colorado, May 2007.*

The importance of dust to global biogeochemical cycles raises several questions about the magnitude, distribution, and variation in dust fluxes across the Earth; this has led to numerous attempts to quantify the contributions of dust sources around the globe. Dust from land disturbed by humans or extreme climatic events, such as drought, may constitute a substantial fraction – perhaps one-third to one-half – of the total atmospheric dust loading (Tegen and Fung 1995). Model assessments indicate that global fluxes are dominated by the large deserts of North Africa, Asia, and the Middle East (Tanaka and Chiba 2006). This global extension can appear to be dominated by non-arable, hyperarid regions, with large interannual variation in dust fluxes controlled primarily by climate (Figure 7).

Dust emissions from some less arid drylands appear to be more heavily influenced by human land use. In the semiarid regions of China, for instance, there is evidence that wind erosion of soils is influenced by grazing activities (eg Liu et al. 2003) and in South and North America, ice and sediment cores reveal that human activity has increased dust deposition over the past 100–300 years. In the western US, lake sediment records from the San Juan Mountains of Colorado show that dust loading reached a peak of ~300% of background (late Holocene) deposition since 1900, when settlement and widespread livestock grazing dramatically increased (Neff et al. 2008). Abandoned cotton fields in Texas and Arizona and military training grounds in Texas and California consistently produce long-regional dust storms that can be seen on satellite imagery

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ally, mainly as a result of fire, abandonment of agricultural fields, overgrazing, and other soil surface disturbing activities (D'Antonio and Vitousek 1992). In wet years, the annual cover is sufficient to stabilize soils and may even exceed the protection offered by the perennial community. However, in dry years, these annual species do not germinate, or die shortly after germination, leaving soils barren and vulnerable to erosion. Dominance by annual plants also accelerates fire cycles. In wet years, these grasses produce sufficient continuous fuels to promote fire in the dry years that follow, leaving post-fire soils vulnerable to erosion.

Dust emissions can become synergistic with changes in climate and land use when one or more of the above factors exceeds a critical threshold. For instance, if land use leads to decreases in plant biomass and cover, as a result of direct impacts to vegetation and shifting of nearby plants (Shardi et al. 1999). When those impacts occur during times of reduced soil moisture, the reduction in plant cover is more general, allowing for increased erosion. Another synergistic series of effects can occur on landscapes where perennial plants have been replaced by annual plants. When these surfaces are then disturbed by livestock or vehicles, an exponential increase in soil loss can be observed, as compared to that in an annual-dominated but uninterrupted landscape (Belnap et al. in press).

In summary, greater dust emissions, including more frequent and larger dust storms, are likely to occur from dryland regions as temperatures increase and more drylands areas are impacted, denuded of vegetation, plowed, and/or converted from perennial to annual plants. These increasing emissions will result in degraded soils and plants at the dust source, as well as in impacts to human and ecosystem health during transport and at deposition points. Avoiding the potentially severe consequences of this future scenario will require a new approach to the management of dryland regions. We need to identify the climatic and acute sources of dust that have potentially large impacts at local, regional, and global scales (Prospero et al. 2003). We also need to better understand how the timing, type, and intensity of different land uses affect dust production. The overarching challenge for ecologists and other environmental scientists, land managers, and policy makers will be to work together to manage vulnerable areas in ways that reduce excess dust production to the fullest extent possible (Okin et al. 2009).

■ Acknowledgements

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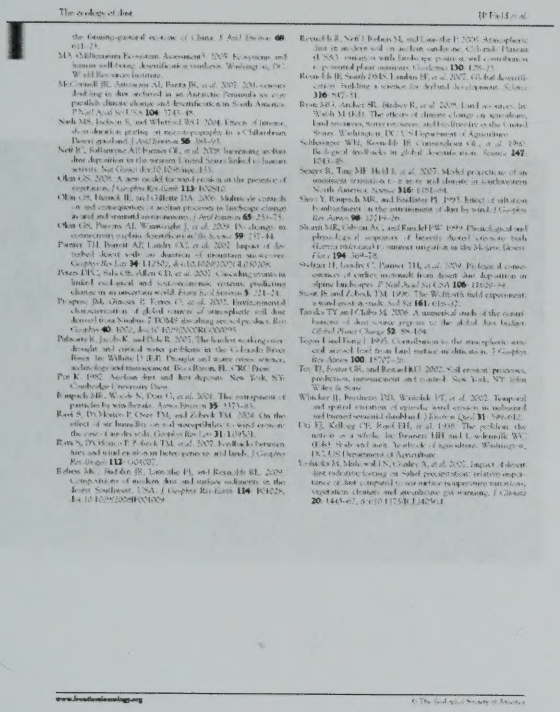

The ecology of dust

IP Field et al.

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Summary of Recent Field Observations of Adverse Health Effects from Wind Developments in Australia,

and

Update from NH&MRC workshop and Australian Senate Inquiry

Dr Sarah Laurie BMBS
Medical Director, Waubra Foundation
Presentation 14th June, 2011
Cape Cod

WAUBRA FOUNDATION

www.waubrafoundation.com.au

What is the Waubra Foundation?

- **Advocacy body** to facilitate independent research into adverse health effects
- **Collect field observations** & then approach independent researchers
- **National Organisation**, links to key acoustic, scientific and medical researchers globally
- **Do not take a pro or anti wind position** – solely concerned with Adverse Health Effects

Location of Wind Developments

Recent Field Observations

- Ongoing data collection from multiple Wind Developments across SE Australia
- Includes information from following sources:
  - interviews with affected residents
  - medical records
  - treating physicians
  - personal health journals
  - acoustic monitoring inside homes

LOCATION OF WIND DEVELOPMENTS in South Eastern Australia

Personal Health Journal Information

date	time	Blood Pressure	Heart rate	Symptoms	Weather conditions	Wind Dir'n	Wind Spee	Turbines turning

Summary of Key Findings

- Over 60 people interviewed so far
- Includes local residents, workers and visitors
- Symptoms characteristic of exposure to wind turbines (never previously experienced) noted up to 10km away
  - Night time waking in panicked state
  - Body vibrations
- Symptoms ALWAYS worsen with increasing exposure over time

Summary of Key Findings cont.

- Consistent with previous findings of Medical practitioners such as
  - Dr Amanda Harry (UK Rural Family Physician)
  - Dr David Iser (Australian Rural Family Physician)
  - Dr Nina Pierpont (US Paediatrician)
  - Dr Robert McMurtry in the Society for Wind Vigilance community health survey
- Many symptoms were known to, and reported by Acousticians such as Dr Leventhall, prior to 2004, in situations of known infrasound & low frequency noise (ILFN) exposure

Report for DEFRA by Dr G Leventhall, Dr P Pelmear & Dr S Benton May 2003
"A review of Published Research on Low Frequency noise and its Effects"

Distance Effect of Wake Turbulence

Summary of Key findings cont.

- Symptoms start to resolve when
  - Turbines are off (especially if more than 24 hours)
  - People move away from turbines

BUT

- People "sensitized" with prolonged exposure then notice symptoms with other sources of ILFN
  - § Pumps
  - § Heating & Cooling compressors/ventilation systems

Health Problems Identified

- **Preexisting medical conditions which worsen with wind turbine exposure**
  - Hypertension (high blood pressure)
  - Angina
  - Diabetes
  - Tinnitus
  - Migraines

Health Problems Identified cont.

- **Severe Frequent Headaches**
  - Head "in a vice"
  - Children with no previous history of headaches
  - Migraines triggered, especially from shadow flicker
- **Visual Blurring**
  - Only occurring with turbine operation
  - Visual checks by health practitioners normal

Health Problems Identified cont.

- **Severe Chronic Sleep Deprivation** (multiple causes which include)
  - Audible turbine noise
  - Waking in a panicked state, wide awake, sometimes on multiple occasions every night
  - Increased nocturnal urination
  - Children's sleep problems
  - Bed vibrating

Health Problems identified cont.

- **Tinnitus** (ringing or buzzing, one or both ears)
- **Ear pressure** sensations (painful at times, especially if previous eardrum surgery)
- **Hyperacusis** (extreme sensitivity to 'normal' sounds)
- **Balance disturbance** (especially in elderly)
- **Motion sickness/vertigo** like symptoms
- **Nausea** (severe)

Health Problems Identified cont.

- **Irritability, extreme anger** and other mood disturbances (also being reported in workers)
- **Memory & Cognitive deficits** (worsening over time)
- **Depression,** at times life threatening
- **Anxiety**
- **Body vibrations**
- **Tachycardias & arrhythmias** (fast & irregular heartbeats)

Clinical Evidence for Sympathetic Nervous system stimulation

- ILFN Induced Sympathetic nervous system stimulation, via Vestibular stimulation or direct stimulation of the brain, is experienced ACUTELY by the person affected as:
  - Tachycardia (fast heart beat)
  - Elevated blood pressure including acute hypertensive episodes
  - Tako Tsubo heart attack episodes
  - Nighttime waking in a panicked state
  - Acutely anxious feelings
  - Unmasking of previous PTSD symptoms (but either well controlled or in abeyance at time of initial exposure to wind turbines)

Additional Clinical Observations

- Reports emerging of two specific clinical illnesses known to be **caused by surges of adrenaline** occurring with exposure to wind turbines (and other sources of ILFN)
  - **Tako Tsubo** heart attacks
  - **Acute Hypertensive Crises**
- Limited animal studies confirm infrasound exposure can result in adrenaline surges
  (NIEHS Toxicology of Infrasound report 2001)

Additional Clinical Observations cont

- Observations of new onset hypertension (high blood pressure) with turbine operation
- Multiple causative mechanisms likely, probably concurrent
  - § Infrasound (experimental studies have shown this effect, via direct or indirect (vestibular) stimulation of sympathetic nervous system 'fight – flight')
  - § Stress
  - § Sleep Deprivation

Qibai and Shi (2007) The Effects of Low Frequency Noise and Vibration on People (ed Prof C. Hansen) *An Investigation on the Physiological and Psychological Effects of Infrasound on Persons* 303-310

Predictors of Onset & Severity

Predictors of **Rapid Onset of Severe Symptoms** of Wind turbine Syndrome (WTS) appear to be

a)**Living downwind of a line of turbines** (cumulative impact)

a)**Presence of ground borne (seismic) vibrations**

- § Beds vibrating
- § Glass of water vibrating

Other reports of residential overnight exposure to ILFN

- **Overnight exposure to ILFN** seems particularly **damaging to health**
- Others who have developed similar health problems including Tako Tsubo Heart attacks, sleep deprivation and high blood pressure which start to partially resolve when exposure ceases
  - **Residents in suburban Melbourne** next to industrial chillers at Melbourne University
  - **Residents 5km away from open cut coal mining** activities active at night (diesel machinery)

Cumulative Impact

Links to Vibro Acoustic Disease

- Substantial body of work by Professor Mariana Alves Pereira & Dr Nuno Castelo Branco over 30 years in Portugal
- Serious health concerns (VAD) with chronic exposure to ILFN (variety of sources)
- Based on their recent work, **levels of measured ILFN inside homes near wind developments will result in VAD in residents**

Tissue Pathology observed in VAD

- **Thickened collagen**, resulting in
  - Decreased lumen of blood vessels (arteries)
  - Thickening of exterior lining of the heart (pericardium)
- **Malignant tumours** in the sole autopsy case
  - (patients with WTS have been noted to have elevated cortisol which will certainly decrease the body's own immunity and ability of the immune system to eradicate abnormal cells over time)

The relationship between WTS & VAD

- I think Dr Pierpont is right, in stating as she did in Ontario that maybe we should call WTS "ILFN syndrome"
- Acousticians for years have been calling these symptoms "annoyance" without Medical Clinicians realising that there are serious health problems emerging with acute and chronic exposure (with a few notable exceptions such as Dr Harry, Dr Iser, Dr Pierpont & Dr Castelo Branco)

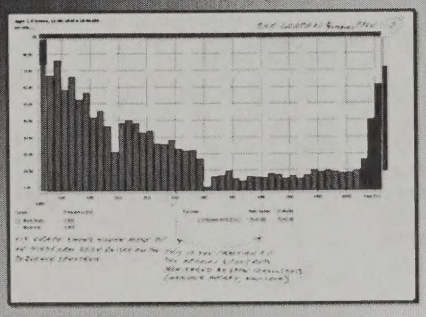
Tissue Pathology observed in VAD

- Professor Alves Pereira also described collagen pathology found in horses on the farm in Portugal, using a case control design
  - Ie collagen changes are "cross species", adding further weight to the evidence of a biological causal effect of ILFN on tissue with chronic exposure

The relationship between WTS & VAD

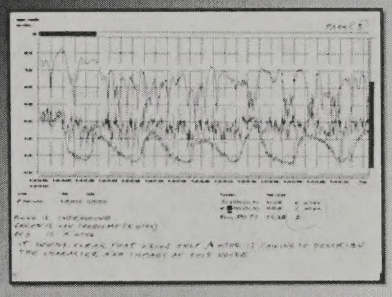
- My conclusions
  - There are multiple pathophysiological mechanisms causing the pathology we are seeing
  - **There is a difference between the effects and therefore the symptoms of acute exposure (WTS) and chronic exposure (VAD)**
  - There may be a synergistic effect eg angina
    - Acute effect – adrenaline surge leading to vasoconstriction
    - Chronic effect – collagen thickening producing structurally narrowed diameter of blood vessel
    - BOTH PATHOLOGIES ACTING TOGETHER WILL RESULT IN DECREASED BLOOD FLOW TO THE HEART MUSCLE

Acoustics Field Data from inside Noel Dean's bedroom, Waubra



Outcome - Home Abandonment

Acoustics Field Data from Inside Noel Dean's bedroom at Waubra



Waubra Foundation Strategies

- **Empower** affected residents with information
- **Educate** treating Medical Practitioners
- **Publicise** the problems via the media & community information sessions
- **Data Collection** (local residents leading the way with personal health journals)
- **Liase** with Researchers **globally**
- **Liase** with Politicians and Bureaucrats **locally**

Mechanisms for harm to health

- **KNOWN** – audible noise
- **HIGHLY LIKELY** – Infrasound & low frequency noise
  - § Airborne pulsations
  - § Resonance within dwellings
  - § Seismic (ground borne) vibrations
- **POSSIBLE** – Electromagnetic radiation effects
- **OTHER?**

Research Questions

1. What is a 'safe' setback distance?

1. What are the mechanisms of causation?

What we know already

1. **Chronic severe sleep deprivation and high blood pressure are very damaging to health** (extensive peer reviewed research)
2. **Both are being identified as new health problems** in residents adjacent to wind developments after commencement of turbine operation
3. **Both are measureable**

These need to be investigated and quantified

Waubra Foundation Research Priorities

- **Concurrent audible noise & ILFN monitoring <u>inside</u>** people's homes with symptom reports, and
  - §sleep studies,
  - §blood pressure studies (24 hour ambulatory blood pressure)
  - §Biochemical indices (cortisol)

Data collection from Residents up to 10km away from turbines

Waubra Foundation Research Priorities

- **Replication** of Dr Michael Nissenbaum's recent study of Sleep, Depression & Quality of Life
- **Case control study** - effect on children's sleep, learning & cognition

Waubra Foundation Research Priorities

- **Monitoring of Worker's Health**
  - Partnership with key Occupational Health and Safety Stakeholder
  - Development of prospective audit program
- **Retrospective analysis** of case reports of Tako Tsubo heart attacks from medical records
- **Prospective collection of clinical and biochemical data** from Tako Tsubo episodes and acute hypertensive crises from multiple sites
- **EMF measurement**

Waubra Foundation Research Priorities

- **Epidemiological studies** to investigate
  - range of medical and psychiatric health problems being experienced, and
  - Analysis of their severity
- **Prospective case control study** of residents adjacent to two small wind developments (2-3 turbines) in Victoria

Update – NH&MRC workshop 7th June, 2011 Canberra

- Variously described as a "Workshop" and a "Scientific Forum"
- Battleground is probably a more accurate descriptor!
- First time affected residents, health bureaucrats, academics, advocacy groups and wind developers were together
- Panel of speakers represented various points of view, followed by small group workshops

Update, NH&MRC workshop cont.

- The two speakers who presented clear evidence of serious health problems resulting from wind turbines (Professor Alves Pereira & Dr Bob Thorne) were
  - Clear & concise
  - Evidence based
  - talked about their own empirical research

Update – Australian Senate Inquiry report tabled 14th June, 2011

- Tabling of report delayed yet again – now due Wednesday 22nd June
- Senator Fielding (instigator of inquiry) leaves Parliament on 30th June
- Widespread suspicions of politicisation of inquiry outcome
  - § Green Senator is Chair of committee
  - § 2 Labor Senators
  - § 1 Liberal Senator (Senator Judith Adams)
  - § 1 Family First (Senator Steve Fielding)

Update, NH&MRC workshop cont

- In contrast, the other two presenters had **no primary research in this area of their own**, and **misrepresented research of others** which they did talk about, in order support their "case"
- Conclusion from most attendees at the forum (with the exception of some developers) is that
  - There is further independent research required
  - Those asserting "there is no problem" are on increasingly shaky ground

Update – Australian Senate Inquiry report tabled 14th June, 2011 cont.

Individuals and groups supportive of wind development who **agreed there was a need to address the health concerns** in their oral or written testimony included

- CFMEU (construction union sub no 638)
- Clean Energy Council CEO Mr Matthew Warren p31, Melbourne Hansard transcript
- Mr Simon Holmes a Court (sub no 628, and p62 Melbourne Hansard transcript)
- Professor Simon Chapman, p118 Melbourne Hansard transcript
- Mr Lane Crockett, Pacific Hydro, p 76 Melbourne Hansard
- Mr Cam Walker, Friends of the Earth, p 118 Melbourne Hansard

National Wind Watch

November 30, 2010
Health, Noise

Adverse health effects: Summary of presentations

Pierpont, Nina

The following is the abstract of Dr. Pierpont's keynote address before the "First International Symposium on the Global Wind Industry and Adverse Health Effects: Loss of Social Justice?" in Picton, Ontario, Canada, October 29–31, 2010, followed by a discussion of other relevant talks at the symposium by Alec Salt, Michael Nissenbaum, Christopher Hanning, and Richard James.

Wind Turbine Syndrome & the Brain — Abstract

The latest research, as discussed below, suggests the following mechanism for Wind Turbine Syndrome: air-borne or body-borne low-frequency sound directly stimulates the inner ear, with physiologic responses of both cochlea (hearing organ) and otolith organs (saccule and utricle — organs of balance and motion detection).

Research has now proved conclusively that physiologic responses in the cochlea suppress the hearing response to low-frequency sound but still send signals to the brain, signals whose function is, at present, mostly unknown. The physiologic response of the cochlea to turbine noise is also a trigger for tinnitus and the brain-cell-level reorganization that tinnitus represents — reorganization that can have an impact on language processing and the profound learning processes related to language processing.

New research also demonstrates that the "motion-detecting" otolith organs of mammals also respond to air-borne low-frequency sound. Physiologic responses and signals from the otolith organs are known to generate a wide range of brain responses, including dizziness and nausea (seasickness, even without the movement), fear and alerting (startle, wakefulness), and difficulties with visually-based problem-solving.

Increased alerting in the presence of wind turbine noise disturbs sleep, even when people do not recall being awakened. A population-level survey in Maine now shows clear disturbances of sleep and mental well-being out to 1400 m (4600 ft) from turbines, with diminishing effects out to 5 km (3 miles).

[*Click here to download entire talk: "Wind Turbine Syndrome & the Brain"* [1].]

Alec Salt, PhD, demolishes A-weighting noise measurements, while demonstrating that the ear has a physiological response to low frequency noise at the intensities produced by wind turbines

Professor Alec Salt is a cochlear physiologist, a laboratory scientist in the Department of Otolaryngology at the Washington University School of Medicine in St. Louis. He and his students study the fluids and physiology of the cochlea (the hearing part of the inner ear) in guinea pigs.

For years, Salt and his colleagues have used infrasound to change the way parts of the cochlea behave — not because they were interested in infrasound, but because it has physiologic effects which are useful in their studies of cochlear fluids and cells.

In the last year or so, Dr. Salt documented that the two types of sensory cells in the cochlea, the inner and outer hair cells, react differently to infrasound. The inner hair cells, which are the ones that send hearing signals to the brain, do not respond to infrasound, but the outer hair cells do.

Infrasound, he discovered, makes the outer hair cells move in such a way that they prevent the inner hair cells from responding. The outer hair cells also send neural signals to the brain and to other outer hair cells, but it is not clear what these signals do once they reach the brain. One thing we do know is that they don't convey sound stimuli, themselves. Some evidence suggests they may play a role in mediating the perception of loud sounds in the cochlear nucleus, the first relay point for sound impulses in the brain.

What's significant for Wind Turbine Syndrome is Dr. Salt's discovery that the cochlea does indeed respond to infrasound, and sends signals to the brain in response to infrasound, but the anatomy and cellular responses of the outer hair cells actively prevent us from hearing the infrasound.

Wondering whether these findings had any significance to people and their diseases, Dr. Salt searched the medical literature last winter and came across Wind Turbine Syndrome. He subsequently published a research article linking his findings to the symptoms or clinical manifestations of Wind Turbine Syndrome.

It's worth emphasizing that Professor Salt is an outstanding educator, as is clear from his website. There is a lot to be learned here about the inner ear, complete with moving, colored, 3-D simulations.

His recent research article is posted here, with a user-friendly discussion of its significance. There is also a link to the website of the National Institutes of Health, where his research is featured. He has also posted the slides from his presentation at the Picton conference on October 30.

In his presentation, Dr. Salt compared measured wind turbine sound spectra, not only to the human hearing response curve (as the wind industry consultants do), but also to the separate response curves of the inner and outer hair cells, showing that wind turbine low-frequency noise and infrasound are easily detectable by the normal cochlea. He also demonstrates how A-weighted sound level measurements specifically exclude the low frequencies significant in wind turbine health effects, effectively demolishing the credibility of A-weighted noise measurements.

Dr. Salt's research is exciting and useful because it pointedly disproves the wind industry's assertion that the infrasound produced by wind turbines is not relevant to human health because it is, they claim, below the hearing threshold of most people. On the contrary, the ear has a physiological response to low frequency noise at the intensities produced by wind turbines, even when this noise cannot be heard.

A physiologic response opens the door, of course, to clinical effects.

With regard to the mechanism of Wind Turbine Syndrome, we are now in the interesting position of having, on the one hand, a demonstrated cochlear response to infrasound

without a known brain response. On the other hand, if we consider the vestibular (balance) organs in the inner ear (which share physiology and fluid connections with the cochlea), we know a lot about brain responses. There is a large scientific literature on what the brain does with normal or distorted vestibular signals with regard to sensations, symptoms, brain cell pathways, and functional and experimental problems.

We also know that the symptom complex of Wind Turbine Syndrome is very similar to the symptoms of vestibular dysfunction.

What is lacking is direct evidence for air-borne infrasound stimulating the hair cells of the vestibular organs. Dr. Salt told us in his conference talk that the vestibular hair cells are "tuned" (meaning, have their best response) to body-borne vibrations at infrasonic frequencies, but that no one has yet looked at the responses of these cells to "acoustic" (meaning, air-borne) infrasound coming in through the outer and middle ear.

"Jumping mice": Mammalian balance organs detect air-borne low-frequency sound using their otolith organs (saccule & utricle)

I suspect it's only a matter of time — and short time, at that — before some research group shows air-borne infrasound stimulating the vestibular hair cells, or shows a human vestibular response to air-borne infrasound. I base my prediction in part on a new article Dr. Salt sent to me immediately after the conference, titled, "The vestibular system mediates sensation of low-frequency sounds in mice." In it, the authors explain how the "ancestral acoustic sensitivity" of the saccule has been retained not only in fish and amphibians, but also, according to recent evidence, in birds and mammals.

The authors demonstrate how normal otolith organs respond to air-borne, low-frequency sounds below the detection range of the mouse cochlea.

Mice jump when startled by a beep. They startle more, with a more vigorous jump, in the presence of a low- or mid-frequency background sound. The authors measured this "startle response" — how much the mice jumped — quantitatively on little electronic platforms. Genetically normal mice jump more in response to either low- or mid-frequency background sound, but the authors also tested mice which, for genetic reasons, never developed the otoconia (little stones) in their otolith organs (utricle & saccule). Significantly, these otolith-deficient mice did the extra-large jumps only when the background sound stimulus fell within the frequency range of the mouse cochlea. They didn't detect the low-frequency background sound stimuli the way the mice with functioning otolith organs did.

Jumping mice. The authors of this study have demonstrated that mammalian ears, using their otolith organs of balance and motion detection, detect air-borne low-frequency sound at frequencies too low to be heard by their cochleas. This makes them startle more. Now consider "jumping people" — startled right out of bed in the middle of the night in the presence of sub-audible, low-frequency noise, or infrasound, from wind turbines.

Evidence like this suggests the following mechanism for Wind Turbine Syndrome: air-borne or body-borne low-frequency sound directly stimulates the inner ear, with physiologic responses of both cochlea and otolith organs.

Physiologic responses in the cochlea suppress the hearing response to low-frequency sound but still send some signals to the brain, signals whose function is, at present, mostly unknown. The physiologic response of the cochlea to turbine noise is also a trigger for

tinnitus and the brain-cell-level reorganization that tinnitus represents — reorganization that can have an impact on language processing and the learning processes related to language processing. Physiologic responses and signals from the otolith organs tie into a wide range of known brain responses to vestibular signals, including dizziness and nausea (seasickness without the movement), fear and alerting (startle, wakefulness), and difficulties with visually-based problem-solving.

[*Click here for Salt's presentation: "Infrasound: Your ears 'hear' it but they don't tell your brain"* [2].]

Christopher Hanning, MD, and sleep arousal

The interaction between sleep and these ear-brain mechanisms is interesting. Wind turbines create a particularly disturbing kind of noise with high alert potential, Dr. Chris Hanning, a sleep specialist, explained at the conference.

Our sleep is disturbed not only when we wake up completely, but also by subclinical arousals — in which the body and brain move into a lighter phase of sleep without waking all the way up. This type of disturbance requires even less noise than full awakening, but still disrupts sleep and its restorative properties for mood, memory, thinking, alertness, and coordination.

People vary in how deeply they sleep, and how resistant they are to awakening or arousal by noise. We can reliably measure how much people are disturbed during sleep using questionnaires about their daytime functioning.

[*Click here for Hanning's report: "Sleep disturbance and wind turbine noise"* [3].]

Rick James, Noise Control Engineer: Sick Building Syndrome

Turning to noise studies around wind turbines, noise control engineer Rick James presented sound monitoring data showing the disturbing, high-alert qualities of wind turbine noise: high levels of low frequency noise and infrasound, and the pulsating quality of the low frequency noise and infrasound. Both the audible noise and the infrasound from turbines are subject to "amplitude modulation" (meaning, the loudness goes up and down) — a quality that adds markedly to its disturbing character.

The arrangement and spacing of turbines in clusters also affects how much noise they make, because a second turbine, heating in the downwind turbulence of the first turbine, makes more noise.

Mr. James reviewed research from the 1980's and '90's on illness in office workers, induced by low-frequency noise from misaligned fans or vibrating ducts in the heating, ventilation, and air conditioning systems of large buildings. Research on these specialized cases of "Sick Building Syndrome" focused on the detrimental effects of low frequency noise on work productivity, and included experimental assessment of low frequency noise effects on concentration and mood.

A word of caution, however. The term "Sick Building Syndrome" is associated most commonly with problems of indoor air quality (including particulates, allergens, infectious particles, solvent odor, and the amount of fresh air), and the syndrome includes irritation of the skin, eyes, and respiratory tract, as well as fatigue, headache, poor concentration,

nausea, and dizziness. The latter symptoms are commonly associated with low frequency noise exposure in other contexts, whereas skin and mucous membrane irritation are not.

In other words, although Wind Turbine Syndrome shares the noise-related aspects of Sick Building Syndrome, the two terms are not the same.

[*Click here for an article in Audiology Today by James and others: "Wind-turbine noise: What audiologists should know."* [4].]

Michael Nissenbaum, MD, reports that surveyed subjects up to 3 miles from turbines showed effects on sleep and mood that varied directly with distance from the turbines

Finally, Dr. Michael Nissenbaum, a Maine physician, presented results of a study of 79 adults living up to three miles from wind turbines in Maine, who completed (what are clinically called) validated questionnaires on sleep disturbance and general physical and mental well-being, divided into study and control groups based on distance from turbines.

Dr. Nissenbaum found differences between the study and control groups in several sleep quality indices, and in the mental health component of the general questionnaire. Even more remarkable, when he pooled the data from study and control groups, he found a dose-response relationship out to about 5 km (3 miles) from turbines. Subjects up to 3 miles from turbines, whether they were initially considered to be in the study or control groups, showed effects on sleep and mood that varied directly with distance from the turbines, Dr. Nissenbaum reported.

This is a valuable study. The surveys required information only about the subjects' current state of sleep and well-being, without reference to the turbines. The impact of turbine noise is apparently seen much farther away than the 1.5-2 km minimum setback proposed by many researchers (including me), although there was a drop-off in symptoms beyond 1.4 km. The questionnaires did not sample the full range of Wind Turbine Syndrome symptoms, but provide a standardized and quantified measure of one important symptom — sleep disturbance — and of general medical and mental health in relation to turbines.

[*Click here for Nissenbaum's presentation to the Maine Medical Association: "Mars Hill Wind Turbine Project Health Effects — Preliminary Symptoms Survey Results."* [5].]

Download original document: "Wind Turbine Syndrome & the Brain" [1]

URLs in this post:
[1] Click here to download entire talk: "Wind Turbine Syndrome & the Brain": **http://www.wind-watch.org/documents/wp-content/uploads/WTSbrain-BW.pdf**
[2] Click here for Salt's presentation: "Infrasound: Your ears 'hear' it but they don't tell your brain": **http://www.wind-watch.org/documents/infrasound-your-ears-hear-it-but-they-dont-tell-your-brain/**
[3] Click here for Hanning's report: "Sleep disturbance and wind turbine noise": **http://www.wind-watch.org/documents/sleep-disturbance-and-wind-turbine-noise/**
[4] Click here for an article in Audiology Today by James and others: "Wind-turbine noise: What audiologists should know": **http://www.wind-watch.org/documents/wind-turbine-noise-what-audiologists-should-know/**
[5] Click here for Nissenbaum's presentation to the Maine Medical Association: "Mars Hill Wind Turbine Project Health Effects — Preliminary Symptoms Survey Results":

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K-Selected Books
Santa Fe, NM

Wind Turbine Syndrome & the Brain

Nina Pierpont, MD, PhD[1]

November 15, 2010

[1] The following is the text of Pierpont's keynote address before the "1st International Symposium on the Global Wind Industry and Adverse Health Effects: Loss of Social Justice?" in Picton, Ontario, Canada, October 30, 2010. It is followed by a discussion of several other relevant talks at the symposium by Drs. Alec Salt, Michael Nissenbaum, Christopher Hanning, and Mr. Richard James.

Abstract

The latest research, as discussed below, suggests the following mechanism for Wind Turbine Syndrome: air-borne or body-borne low frequency sound directly stimulates the inner ear, with physiologic responses of both cochlea (hearing organ) and otolith organs (saccule and utricle—organs of balance and motion detection).

Research has now proved conclusively that physiologic responses in the cochlea suppress the hearing response to low-frequency sound for still sound signals to the brain, signals whose function is, at present, mostly unknown. The physiologic response of the cochlea to broadband noise is also a trigger for tinnitus and the brain cell-level reorganization that tinnitus represents—reorganization that can have an impact on language processing and the profound learning processes related to language processing.

New research also demonstrates that the "motion-detecting" otolith organs of mammals also respond to air-borne low-frequency sound. Physiologic responses and signals from the otolith organs are known to generate a wide range of brain responses, including dizziness and nystagmus (sound-driven, even without the movement), fear and alerting (startle, wakefulness), and difficulties with visually-based problem-solving.

Increased activity in the presence of wind turbine noise disturbs sleep, even when people do not recall being awakened. A population-level survey in Maine now shows clear disturbances of sleep and mental well-being out to 3400 m (4600 ft) from turbines, with diminishing effects out to 5 km (3 miles).

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[1] **Nina Pierpont, MD (Johns Hopkins), PhD (Princeton: Population Biology).** Pierpont is a Fellow of the American Academy of Pediatrics and former Clinical Assistant Professor of Pediatrics at the College of Physicians & Surgeons, Columbia University, New York, NY. She is currently in private practice, doing chiefly behavioral medicine in both children and adults. She can be reached at ge.pierpont@gmail.com. Her book, "Wind Turbine Syndrome: A Report on a Natural Experiment" (2009), is available from Amazon.com and www.windturbinesyndrome.com.

Sensory systems change brain functioning

I confess I have an odd medical practice. I'm a pediatrician by training, but I'm fascinated by fevers and development, and essentially practice psychiatry and child development. I'm interested in how to help children's brains grow well, and at the other end of the spectrum, in what details normal brain functioning in normal people—like Wind Turbine Syndrome—and how to get that functioning back on track.

So much of brain function is about the sensory systems—vision, hearing, touch—and what the brain does to take those sensory signals from all over the body and turn them into a coherent picture of where this particular creature—oneself—is at this particular time, and what needs to happen next to meet its needs. Those needs range from the basic and physiologic—like breathing and pumping blood in the right amounts to the different parts of the body—to complex social and language-based needs, like figuring out what your spouse really meant by that last thing he said. Our sensory systems mediate all of these needs.

Sensory systems change brain functioning. They affect not only what a person or animal feels or thinks at that very moment, but also how that brain will function in the future, even the near future. This is called neuroplasticity: the neural basis of learning, for which Eric Kandel won the Nobel prize in 2000.[1]

Tinnitus: The brain makes up sound where no sound exists

Take, for example, tinnitus, or ringing in the ears—an important sensory problem in Wind Turbine Syndrome. Ringing, buzzing, sizzling, or waterfall noises—my study subjects described all of these, sometimes in the head as well as the ears.

58% of the adults and older teens in my sample of affected families had tinnitus. In the general population, it's 4%. People with a prior history of hearing loss or industrial noise exposure were especially likely to get tinnitus, but other people in the study also got it, without these risk factors.

Among people with tinnitus in general, many have damage to their cochlea, the snail-shaped organ of hearing in the inner ear. Because of this damage, many researchers have heretofore thought that tinnitus originates in the cochlea, as distorted hearing signals—the cochlea being somehow able to produce nerve signals of sound without the sound being there in the environment.

We are now getting quite a different picture of tinnitus. People with auditory nerves (meaning the nerve from the cochlea to the brain) that have been completely cut (for example, because of a tumor on the nerve) also have tinnitus, although, again, there is no input from the cochlea to the brain at all.

Recently, functional imaging studies (like MRI or PET scans) of people with tinnitus have supported the idea that tinnitus arises not in the ear, but in the parts of the brain that perceive sound. The trigger is an absence of input from the cochlea or parts of the cochlea. Essentially, your brain makes up sound where no sound exists.

It's like phantom pain that people get when they have lost a limb. There is no nerve input from the limb because it's gone; nevertheless, the person experiences the limb hurting.

Tinnitus is like this—it's phantom noise. It can be an excruciating and unpleasant sensation.

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1. Kandel ER. 2000. The molecular biology of memory storage: a dialog between genes and synapses. Nobel Lectures. Click here.

This type of change in the brain (like what happens with tinnitus) happens quickly. We learn this from a journal as unimpeachable as the New England Journal of Medicine, the gold standard in America for medical research. Describing the pathophysiology of tinnitus, a review article published in 2002 stated:

> Hearing loss leads to a reorganization of the pathways in the central [brain] auditory system. These changes may occur rapidly and lead to abnormal interactions between auditory and other central [brain] pathways.[2]

What's happening here is that the cells in the brain are making new connections, not good connections. It's like chaos in the brain, and the result is hearing a noise that isn't really there.

Wind Turbine Syndrome & tinnitus

Now listen to this story from Wind Turbine Syndrome.[3] A real Canadian family, family A in my study. We'll call them the Smiths. We'll call them Frank, Marlene, and their 2½ year old boy, Justin.

Frank, age 32, is a healthy fisherman who owns his own boat, Turbinos, 30 in a row pounding at the horse, the closest 1 km away, go online. For the first three weeks, Frank has repetitive popping in his ears, like pressure changes. After three weeks, a continuous headache starts whenever he's at home. It resolves after several hours every time he leaves this house, and comes back within several hours of coming home. Several weeks after the headache started, tinnitus starts and worsens over the duration of the 5-month exposure, until the family abandoned their home and rented a house in town.

Marlene, his wife, a 33-year-old accountant, likewise noticed repetitive popping in her ears for the first three weeks. She also noticed she couldn't hear as well as before. After three weeks, the tinnitus began. The tinnitus continued and worsened over time during the 5 months of exposure, varying according to how much she was at home and how loud the turbines were. After the exposure ended, she told me, the tinnitus resolved, but she is noticed a new difficulty understanding conversation in a noisy room. She noticed she had to watch the speaker's face more closely.

During exposure, young Justin, a healthy 2½-year-old, pulled on his ears and got cranky at the same times that adults in the family noticed more headache and tinnitus. His language development was good before, during, and after exposure, but his mother noticed during exposure that the child began to confuse T with K sounds and W with L sounds, which he had not done before. This sound confusion was ongoing six weeks after exposure ended, when I interviewed the parents.

Let's match the research to the clinical account—match medical science to this real family. These two adults experienced pressure changes in their ears for some weeks, one with some loss of hearing. They then developed tinnitus. The tinnitus resolved when the noise exposure ended, but Marlene still noticed subtle differences in her own auditory processing and in her child's, Justin's.

Picking out one voice against background noise is an example of brain (or central) auditory processing, which means how your brain takes signals coming from your ears and puts them together into language, music, the song of a hermit thrush, or other recognizable and meaningful sounds.

2. Lockwood AH, Salvi RJ, Burkard RF. 2002. Tinnitus. N Engl J Med. 347(12): 904-10.

3. Pierpont, N. Wind Turbine Syndrome: A Report on a Natural Experiment. K-Selected Books. 2009. 294 pp.

To pick out one sound from background noise, your brain processes simultaneous signals from both ears, integrating the signals into a new type of perception that transcends what either ear can do alone. (It's sort of like depth perception with two eyes.)

Hearing in background noise is one aspect of brain auditory processing, and one that audiologists often test. Distinguishing language sounds is another critical part of how the brain processes sound, especially for children learning language.

So, what do we have? We have the New England Journal telling us that auditory pathways in the brain reorganize rapidly when there are defaults in the input from the ears, producing tinnitus. (Let's not ignore that this "reorganization" represents deterioration in function—not an improvement. Contrast this to the process of brain organization that occurs as a child learns language.) We have this research on the one hand, and on the other, younger healthy adults telling us their observations of their own hearing and hearing-related processes as they passed through a substantial load of noise exposure.

Marlene described the noise, by the way, as: "Not noisy like a chainsaw, more like pulsating annoyance. To another person it wouldn't sound loud."

I suspect that in a child as young as Justin, 2½, who was removed from exposure so quickly, this process is entirely reversible. But such effects are less likely to be reversible with older age or longer exposure. That's a basic principle of how brains develop.

Noise exposure, even at relatively low sound levels, fouls up the parts of the brain responsible for figuring out language sounds, and the parts responsible for understanding and learning and remembering things we hear or read

I'm basing this interpretation of the Smith's experience on the tinnitus research and also on another area of research—on the effects of other types of environmental noise (like airport or traffic noise) on children's learning.

Learning to read is a language-intensive process that is especially sensitive to the effects of noise in school or at home. This effect is distinct from the effects of noise on attention or working memory,[4] and is correlated with measures of sound processing such as speech recognition.[5]

In one study, for example, a German city closed an old airport and built a new one. Researchers had the opportunity to follow the reading skills of both sets of children over time. Those living near the airport that closed showed improvement in their reading. The ones near the new airport slowed down in their learning after the airport opened.[6]

4. Haines MM, Stansfeld SA, Job RFS, Berglund B, Head J. 2001. A follow-up study of effects of chronic aircraft noise exposure on child stress responses and cognition. Int J Epidemiol.30: 839-45.

5. Evans GW, Maxwell L. 1997. Chronic noise exposure and reading deficits: the mediating effects of language acquisition. Environ Behav 29(5): 638-56.

6. Hygge S, Evans GW, Bullinger M. 2002. A prospective study of some effects of aircraft noise on cognitive performance in schoolchildren. Psychol Sci 13: 469-74.

Another study looked at the effects of noise on both reading and auditory processing in children who lived in an apartment building next to a busy highway. Auditory processing, again, is what your brain does with the signals from your ears to turn them into meaningful language or other sounds.

The higher the children lived in the building, the quieter were their apartments and the better their reading and auditory discrimination scores, which means, for example, distinguishing the word *goat* from *boat*. The study factored out the effects of parent education and income, and then found that children exposed to more noise were more delayed in their reading. The amount of delay in reading was explained by how badly the children were doing distinguishing language sounds from each other, which also worsened with more noise.[7]

In other words, the presence of noise in the environment degraded how the children's brains processed language sounds, which in turn degraded their ability to learn to read. It wasn't that the noise just kept them from hearing things they needed to learn; the noise actually harmed their brain's ability to process language, even when that language was coming in through their eyes, as it does when we read.

Moreover, these effects of noise on reading occur at sound levels far less than those needed to produce hearing damage.[8] Children at higher grade levels are more affected, and longer exposures produce larger deficits, other studies have shown.[9]

In my wind turbine study, 7 out of the 10 school-age children and teens did worse in school during exposure to turbines, compared to before or after, including unexpected problems in reading, math, concentration, and test performance, noticed by both teachers and parents. Test flows went miles home, asking what was wrong with the children.

Subtle as these effects are, they have serious implications. Noise exposure, even at relatively low sound levels, fouls up the parts of the brain responsible for figuring out language sounds (what we call language processing) and the parts responsible for understanding and learning and remembering things we hear or read (what we call language-based learning).

Let me emphasize: Noise exposure, even at low levels that don't damage hearing, can do this.

The Balance Organs: A protean presence in the brain, in terms of what types of sensations they draw on and how the information is used by the brain

There is another set of organs in the inner ear, the organs of balance (called the vestibular organs), consisting of the utricle and saccule (the two otolith or "ear rock" organs, where microscopic stones control our perception of gravity and movement in a straight line) and the semicircular canals, which detect rotations of the head in three planes.

The balance system is probably the least well known of all the senses by both the general public and physicians. It's a

7. Cohen S, Glass DC, Singer JE. 1973. Apartment noise, auditory discrimination, and reading ability in children. J Exp Soc Psychol 9: 407-22.

8. Evans GW. 2006. Child development and the physical environment. Annu Rev Psychol 57: 423-51.

9. Evans 2006.

different kind of sense. It has some dedicated organs (the vestibular organs in the inner ear, just described), but these organs do not function on their own, not without the cooperation (and brain integration) of multiple sensory signals from all over the body.

We use this sense not just for balance (staying upright), but also for telling where we are in space and how fast and in what direction the different parts of our bodies are moving, at all times.

The vestibular system feeds back instantaneously, for example, on the eye movement muscles and on posture-maintaining muscles in the neck and back. It also adjusts to gravity by controlling tension in the arteries and smaller blood vessels all over the body, and how hard the heart is pumping. To keep the blood evenly distributed whether you are standing up, lying down, or standing on your head.

Balance and motion detection requires input from the eyes, from stretch receptors in the muscles and joints all over the body, from touch receptors in the skin, and, it is now known, from stretch and pressure receptors in and around internal organs and the great blood vessels in the chest and abdomen.[10] As well as requiring signals from the inner ear—the utricle, saccule, and semicircular canals.

This is a remarkable feat of brain integration, especially when the signals don't all agree with one another. The brain has to figure out which signals to downweight or ignore if they don't all agree, or if the signals from one channel are distorted.

Even fish have otolith organs and semicircular canals. The cochlea, or specialized hearing organ, evolved later, our type specifically in mammals. The brain essentially grew up, through evolution, with vestibular neurons and signals already in place. As a consequence, our systems for detecting movement, gravity, pressure, and vibration have a protean presence in the brain, going everywhere, both in terms of what types of sensations they draw on, and how the information is used by the brain.

In fish and amphibians, the otolith organs are much better detectors of low-frequency noise and vibration than are those animals' own versions of sound-detecting organs.[11] We now know that even in mice—a mammal—low-frequency, airborne sound is detected by the otolith organs,[12] in humans, detection of low frequency sound by the otolith organs has been shown only using bone-conducted sound, meaning a source of vibration placed right against the head.

At 500 Hz, the tone of a moderately low note on the piano, healthy adults can detect a bone-conducted vibration at 35 dB below their own normal hearing thresholds, probably through the utricle.[13] "Detection" in this case means that the vibration triggers an automatic reflex in muscles around the eyes or in the neck, a response that can only be due, we know, to vestibular stimulation.

10. Mittelstaedt H. 1998. Somatic graviception. Biol Psychol 1(2): 253-54.

11. Fay RR, Simmons AM. 1999. The sense of hearing in fishes and amphibians. In Comparative Hearing: Fish and Amphibians, ed. Fay RR, Popper AN, pp. 269-317. Springer-Verlag, New York.

12. Saoji O, Narbon HE. 1986. Detection of infrasound by the Mongolian gerbil. J Exp Biol 125: 197-205.

13. Sohn OF, Lekhakhina VA, Rosseel D, Lekhakhin AN. 2010. The vestibular system mediates sensation of low-frequency sounds in mice. J Assoc Res Otolaryngol. 2010 Sep 4. [Epub ahead of print].

14. Todd NPMde, Rosengren SM, Colebatch JG. 2008. Tuning and sensitivity of the human vestibular system to low-frequency vibration. Neuroscience Letter 444: 36-41.

15. Todd NP, Rosengren SM, Colebatch JG. 2009. A cortical origin of frequency tuning to low-frequency vibration in the human vestibular system? Neurosci Lett. 451(3): 175-180.

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All this by way of saying that we are getting clearer to understanding the pathophysiological mechanisms causing Wind Turbine Syndrome.

Wind Turbine Syndrome resembles inner ear pathology without being observed by otolaryngologists

The symptoms of Wind Turbine Syndrome directly mirror the symptom clusters that practicing otolaryngologists have seen for years in patients with balance problems due to vestibular inner ear pathology.[16] With vestibular pathology, however, the symptoms are not known to come and go with noise exposure. Very importantly, the symptoms associated with vestibular pathology are not just about balance or dizziness, as ill-named as it remains. Indeed, the symptoms clinically reveal the linkages between the balance-processing parts of the brain, and cognition and memory—linkages only now being described through experiments and functional brain imaging.

Over 90% of my sample of affected people, both adults and children, had cognitive difficulties during wind turbine exposure—problems that lingered and resolved slowly after exposure ended. These included difficulties with reading, math, spelling, writing, multitasking in kitchen and home, remembering a series of errands, maintaining a train of thought in a telephone conversation, following the plot of a TV show, following recipes, and following directions to put together furniture.

Balance-disordered patients in clinical practice also struggle with short-term memory, concentration, multitasking, arithmetic, and reading. Patients with inner ear fluid leakages, for example, present with symptoms of dizziness, headache, stiff neck, and disturbed sleep, accompanied by marked mental performance deficits compared to baseline.[17]

This kind of inner ear leakage can be set off by whiplash injuries, mild head trauma, or pressure trauma to the ear. The fluid leak is associated with an imbalance of fluid pressures in the inner ear, known as endolymphatic hydrops, which distorts both balance and hearing. (Ménière's disease, in which balance and hearing disturbances fluctuate, is endolymphatic hydrops that comes and goes for unknown reasons.)

Tellingly, Dr. Alec Salt, who will speak next on infrasound effects on the inner ear, has discovered experimentally that infrasound exposure causes temporary endolymphatic hydrops.[18] This is a provable mechanism for the balance disturbances, tinnitus, headache, and cognition problems of Wind Turbine Syndrome.

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16. Gómez RJ, Hemenway WG, Lehew PR, Block FO; 1989. The peripheral fluids syndrome defined in mild head trauma. Acta Otolaryngol Suppl 464: 1-46.

17. Hanes DA, McCollum G; 2006. Cognitive-vestibular interaction: a review of patient difficulties and possible mechanisms. J Vestib Res 16(3): 75-91.

18. Gomez et al. 1989.

19. Salt AN; 2004. Acute endolymphatic hydrops generated by exposure of the ear to nontraumatic low-frequency tones. J Assoc Res Otolaryngol 5(2): 203-14.

Summary

- Wind turbine noise causes illness in many exposed people. Tinnitus at the physiologic level is the result of a change in sound processing by the brain.
- Other types of environmental noise have been shown to impair children's learning by changing how they process language sounds. Families exposed to wind turbines noticed deterioration in their children's thinking and learning abilities during exposure. Adults also had problems with thinking, memory, and concentration during exposure.
- Other clinical and brain studies have shown that diminished thinking and performance are tied to malfunctioning of the vestibular portion of the inner ear.
- Distorted balance signaling has a close connection with panic and anxiety in a variety of situations, a linkage that may explain how panic in the night comes up in previously non-panicked but motion-sensitive people exposed to wind turbines.

Alec Salt, PhD, demolishes A-weighting noise measurements, while demonstrating that the ear has a physiological response to low frequency noise at the intensities produced by wind turbines

Professor Alec Salt is a cochlear physiologist, a laboratory scientist in the Department of Otolaryngology at the Washington University School of Medicine in St. Louis. He and his students study the fluids and physiology of the cochlea (the hearing part of the inner ear) in guinea pigs.

For years, Salt and his colleagues have used infrasound to change the way parts of the cochlea behave—not because they were interested in infrasound, but because it has physiologic effects which are useful in their studies of cochlear fluids and cells.

In the last year or so, Dr. Salt discovered that the two types of sensory cells in the cochlea, the inner and outer hair cells, react differently to infrasound. The inner hair cells, which are the ones that send hearing signals to the brain, do not respond to infrasound, but the outer hair cells do.

Infrasound, he discovered, makes the outer hair cells move in such a way that they prevent the inner hair cells from responding. The outer hair cells also send neural signals to the brain and to other outer hair cells, but it is not clear what those signals do once they reach the brain. One thing we do know is that they don't convey sound of itself, themselves. Some evidence suggests they may play a role in mediating the perception of hearl sounds in the cochlear nucleus. The first relay point for sound impulses in the brain.[20,21]

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20. Brown DJ, Brown MC; 2004. Postsynaptic origin of Type II auditory nerve fibers in the cochlear nucleus. J Assoc Res Otolaryngol 5(3): 341-355.

21. Weisz C, Glowatzki E, Fuchs P; 2009. The postsynaptic function of Type II cochlear afferents. Nature 461(7267): 1126-1129.

The balance system is closely linked to emotions, especially fear, anxiety, and panic

So far, I have talked about how the absence or distortion of hearing signals from the inner ear affects thinking and learning at the brain level, and how distortion of balance signals from the inner ear affects thinking, memory, and concentration at the brain level. There is one more subject in this cluster of sensory/brain-function linkages which I would like to discuss.

The balance system is closely linked to emotions, especially fear, anxiety, and panic. When my foot slides on ice under some new snow and I fling my arms out to regain balance, I have a moment of panic. My husband has fear of heights for reasons directly attributable to his brain's style of balance signal integration. I don't, and love to sit on the edge of cliffs over the ocean, watching seabirds.

When he sees me doing this, or if he gets near the edge himself or goes to the top of a tall building, he feels dizzy and nauseated (which are direct balance problem symptoms) and also panicked and irrational—afraid that he or I might fall or even jump off.

(I didn't have a full sense of this until recently, he's so controlled and calm, but now I understand why he doesn't want to take me back to Newfoundland—where there are huge, wonderful seabird cliffs...)

In some studies of balance-anxiety linkages, up to 80% of people with panic disorder have measurable disorders of balance processing. The places where people panic are those in which they "have their bearings," so to speak, due to distortion of balance signals and their own brains' particular style of dealing with distorted balance signals. Grocery stores have been always a big culprit.

In one wind turbine study, 2/3 of the adult subjects (14 out of 21) experienced a highly disturbing collection of symptoms when exposed to high levels of turbine noise. They felt movement inside their chests, described as quivering, jitteriness, or pulsation, and then an uncomfortable urge to flee—to get out of there. Or, if the hearing awoke them at night, panic, with racing heart, a feeling they could not breathe, or the sense that there just had been an alarming noise—like a window breaking—and that they had to get up to check the house.

Wind Turbine Syndrome panic symptoms linked to previous history of motion sensitivity

None of these people had had panic attacks in their lives before. Several had histories of anxiety or depression, but altogether, among all the adults in the study, a previous mental health problem was not significantly associated with the presence of this panic symptom. What was associated with the panic symptom, with a highly significant statistical relationship, was a previous history of motion sensitivity.

Even a tough cowboy from Missouri, a welder who raises horses, had this symptom awakening him at night near turbines. Once he and his family moved into town, he slept like a baby. No more panic awakening. (It was his wife who had to tell me about it, however.) Even the physician in my study had this symptom. Toddlers and preschool children in my study had a similar symptom—awakening in the night in states of high alarm and unable to go back to bed or to sleep.

In short, noise impinging on the ear is not just about hearing, we are learning, but also about how the brain organizes itself around sound.

What is significant for Wind Turbine Syndrome is Dr. Salt's discovery that the cochlea does indeed respond to infrasound, and sends signals to the brain in response to infrasound, but (the anatomy and cellular responses of the outer hair cells actively prevent us from hearing the infrasound.

Wondering whether these findings had any significance to people and their diseases, Dr. Salt searched the medical literature last winter and came across Wind Turbine Syndrome. He subsequently published a research article linking his findings to the symptoms or clinical manifestations of Wind Turbine Syndrome.[22]

It's worth emphasizing that Professor Salt is an outstanding educator, as is clear from his website. There is a lot to be learned here about the inner ear, complete with moving, colored, 3-D simulations.

His recent research article is posted here, with a user-friendly discussion of its significance. There is also a link to the website of the National Institutes of Health, where his research is featured. He has also posted the slides from his, present ation at the Fiction conference on October 30.

In his presentation, Dr. Salt compared measured wind turbine sound spectra, not only to the human hearing response curve (as the wind industry consultants do), but also to the separate response curves of the inner and outer hair cells, showing that wind turbine low-frequency noise at infrasound are easily detectable by the sound cochlea. He also demonstrates how A-weighted sound level measurements specifically exclude the low frequencies significant at wind turbine health effects, effectively demolishing the credibility of A-weighted noise measurements.

Dr. Salt's research is exciting and useful because it pointedly disproves the wind industry's assertion that the infrasound produced by wind turbines is not relevant to human health because it is, they claim, below the hearing threshold of most people. On the contrary, the ear has a physiological response to low frequency noise at the intensities produced by wind turbines, even when this noise cannot be heard.

A physiologic response opens the door, of course, to clinical effects.

With regard to the mechanism of Wind Turbine Syndrome, we are now in the interesting position of having, on the one hand, a demonstrated cochlear response to infrasound without a known brain response. On the other hand, if we consider the vestibular (balance) organs in the inner ear (which share physiology and fluid connections with the cochlea), we know a lot about brain responses. There is a large scientific literature on what the brain does with normal or distorted vestibular signals with regard to sensations, symptoms, brain cell pathways, and function at and experimental problems.[23]

We also know that the symptom complex of Wind Turbine Syndrome is very similar to the symptoms of vestibular dysfunction.

What is lacking is direct evidence for air-borne infrasound stimulating the hair cells of the vestibular organs. Dr. Salt told us in his conference talk that the vestibular hair cells are "tuned" (meaning, have their best responses) to body borne vibrations at infrasonic frequencies, but that no one has yet looked at the responses of these cells to "acoustic" (meaning, air-borne) infrasound coming in through the outer and middle ear.

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22. Salt AN, Hullar TE; 2010. Responses of the ear to low frequency sounds, infrasound and wind turbines. Hear Res 268(1-2): 12-21.

23. This field is reviewed in Wind Turbine Syndrome, pp. 72-99, 195-204, and 226-244.

"Jumping Mice": Mammalian balance organs detect air-borne low-frequency sound using their otolith organs (sacculE & utricle)

I suspect it's only a matter of time—and short time, at that—before some research group shows air-borne infrasound stimulating the vestibular hair cells, or shows a human vestibular response to air-borne infrasound. I base my prediction in part on a new article Dr. Salt sent to me immediately after the conference. Titled, "The vestibular system mediates sensation of low-frequency sounds in mice."[24] In it, the authors explain how the "ancestral acoustic sensitivity" of the saccule has been retained not only in fish and amphibians, but also, according to recent evidence, in birds and mammals.

The authors demonstrate how mouse otolith organs respond to air-borne, low-frequency sounds below the detection range of the mouse cochlea.

Mice jump when startled by a beep. They startle more, with a more vigorous jump, in the presence of a low- or mid-frequency background sound. The authors measured this "startle response"—how much the mice jumped—quantitatively on little electronic platforms. Genetically normal mice jump more in response to either low- or mid-frequency background sound, but the authors also tested mice which, for genetic reasons, never developed the otoconia (little stones) in their otolith organs (utricle & saccule). Significantly, these otolith-deficient mice did the extra-large jumps only when the background sound stimulus fell within the frequency range of the mouse cochlea. They didn't detect the low-frequency background sound stimuli the way the mice with functioning otolith organs did.

Jumping mice. The authors of this study have demonstrated that mammalian ears, using their otolith organs of balance and motion detection, detect air-borne low-frequency sound at frequencies too low to be heard by their cochleas. This makes them startle more. Now consider "jumping people"—startled right out of bed in the middle of the night in the presence of sub-audible, low-frequency noise, or infrasound, from wind turbines.

Evidence like this suggests the following mechanism for Wind Turbine Syndrome: air-borne or body-borne low-frequency sound directly stimulates the inner ear, with physiologic responses of both cochlea and otolith organs.

Physiologic responses in the cochlea suppress the hearing response to low-frequency sound but still send some signals to the brain, signals whose function is, at present, mostly unknown. The physiologic response of the cochlea to turbine noise is also a trigger for tinnitus and the brain cell-level reorganization that tinnitus represents—reorganization that can have an impact on language processing and the learning processes related to language processing. Physiologic responses and signals from the otolith organs tie into a wide range of known brain responses to vestibular signals, including dizziness and nausea (seasickness without the motion part), fear and alerting (startle, wakefulness), and difficulties with visually-based problem-solving.

Christopher Hanning, MD, and sleep arousal

The interaction between sleep and these ear-brain mechanisms is interesting. Wind turbines create a particularly disturbing kind of noise with high alert potential, Dr. Chris Hanning, a sleep specialist, explained at the conference.

Our sleep is disturbed not only when we wake up completely, but also by subclinical arousals—in which the body and brain move into a lighter phase of sleep without waking all the way up. This type of disturbance requires even less

24. Jones et al. 2010.

noise than full awakening, but still disrupts sleep and its restorative properties for mood, memory, thinking, alertness, and consolidation.

People vary in how deeply they sleep, and how resistant they are to awakening or arousal by noise. We can reliably measure how much people are disturbed during sleep using questionnaires about their daytime functioning.

Rick James, Noise Control Engineer: Sick Building Syndrome

Turning to noise studies around wind turbines, noise-control engineer Rick James presented sound monitoring data showing the disturbing, high-alert qualities of wind turbine noise: high levels of low frequency noise and infrasound, and the pulsating quality of the low frequency noise and infrasound. Both the audible noise and the infrasound from turbines are subject to "amplitude modulation" (meaning, the loudness goes up and down)—a quality that adds markedly to its disturbing character.

The arrangement and spacing of turbines in clusters also affects how much noise they make, because a second turbine, beating in the downwind turbulence of the first turbine, makes more noise.

Mr. James reviewed research from the 1980's and '90's on illness in office workers, induced by low-frequency noise from poor-designed fans or vibrating ducts in the heating, ventilation, and air conditioning systems of large buildings. Research on these specialized cases of "Sick Building Syndrome" focused on the detrimental effects of low frequency noise on work productivity, and included experimental assessment of low frequency noise effects on concentration and mood.[25]

A word of caution, however. The term "Sick Building Syndrome" is associated most commonly with problems of indoor air quality (including particulates, allergens, infectious particles, solvent odor, and the amount of fresh air), and the symptoms include irritation of the skin, eyes, and respiratory tract, as well as fatigue, headache, poor concentration, nausea, and dizziness.[26] The latter symptoms are commonly associated with low frequency noise exposure in other contexts, whereas skin and mucous membrane irritation are not.

In other words, although Wind Turbine Syndrome shares the noise-related aspects of Sick Building Syndrome, the two terms are not the same.

25. Persson Waye K, Rylander Rigle, Persson S, Leventhall HG. 1987. Effects on performance and work quality due to low frequency ventilation noise. J Sound Vibr 205(4): 467-474.

26. World Health Organization. 1982. Indoor air pollutants: exposure and health effects. Pp. 25-28.

Michael Nissenbaum, MD, reports that surveyed subjects up to 3 miles from turbines showed effects on sleep and mood that varied directly with distance from the turbines

Finally, Dr. Michael Nissenbaum, a Maine physician, presented results of a study of 39 adults living up to three miles from wind turbines in Maine, who completed (what one day be called) valid and quantitative sleep disturbance and general physical and mental well-being, checklists study and control groups, based on distance from turbines.

Dr. Nissenbaum found differences between the study and control groups in several sleep quality indices, and in the mental health component of the general questionnaire. Even more remarkable, when he pooled the data from study and control groups, he found a dose-response relationship out to about 5 km (3 miles) from turbines. Subjects up to 3 miles from turbines, whether they were initially considered to be in the study or control groups, showed effects on sleep and mood that varied directly with distance from the turbines, Dr. Nissenbaum reported.

This is a valuable study. The surveys required information only about the subjects' current states of sleep and well-being, without reference to the turbines. The impact of turbine noise is apparently seen much farther away than the 1.5-2 km minimum setback proposed by many researchers (including me). Although there was a drop-off in symptoms beyond 1.4 km. The questionnaires did not sample the full range of Wind Turbine Syndrome symptoms, but provide a standardized and quantified measure of one important symptom—sleep disturbance—and of general medical and mental health in relation to turbines.

The "Humanness" of Wind Turbine Syndrome

Such is the state of Wind Turbine Syndrome research a year after I published "Wind Turbine Syndrome: A Report on a Natural Experiment." As I said earlier, we have made substantial progress in figuring out the mechanisms and other parameters of this industrial plague.

It's worth pointing out that, with one notable exception, none of this was done with government or industry or foundation support—either financial or moral support. And the opposite: governments (of all levels) and the wind energy industry have actively tried to thwart this research. But—this process me immensely—it was accomplished despite their opposition.

The exception being the National Institutes of Health, which funded Dr. Salt's research. All praise to the NIH!

A final word. For me, it was both sobering and energizing to talk, again, with victims of Wind Turbine Syndrome at the conference. At times, distracted by political and journalistic "noise," I forget how serious WTS actually is.

Separately, a man and a woman from different countries told me quietly of their thoughts of committing suicide. Both are older with good marriages and productive lives and adequate resources. One has been driven from her home by relentless nausea and vomiting, and the other is unable to return home.

While governments, the wind industry and its scientific and clinical hirelings, and the media continue to belittle and deny the experiences of these individuals—Lord knows, the media is filled with denial, ridicule, and venom (Google "Wind Turbine Syndrome")—I am reminded, once more, that the physical, mental, social, and financial consequences of this perfectly correctable condition are appalling.

National Wind Watch

April 23, 2010
Health, Noise, Siting

Wind Turbine Syndrome: Excerpts from the Executive Summary

Pierpont, Nina

The core of the book [1] is a scientific report presenting original, primary research on symptomatic people living near large industrial wind turbines (1.5–3 MW) erected since 2004. The findings:

1) Wind turbines cause Wind Turbine Syndrome. We know this because people have symptoms when they are close to turbines and the symptoms go away when they are away from turbines. The study families themselves figured out that they had to move away from turbines to be rid of their symptoms, and nine out of ten have moved. Some sold and some abandoned their homes.

2) The symptoms are sleep disturbance and deprivation, headache, tinnitus (ringing in ears), ear pressure, dizziness, vertigo (spinning dizziness), nausea, visual blurring, tachycardia (fast heart rate), irritability, problems with concentration and memory, and panic episodes associated with sensations of movement or quivering inside the body that arise while awake or asleep.

3) People with pre-existing migraine disorder, motion sensitivity, or damage to inner ear structures (such as hearing loss from industrial noise exposure) are more susceptible than other people.

4) Symptoms are not statistically associated with pre-existing anxiety or other mental health disorders.

5) The symptom complex resembles syndromes caused by vestibular (inner ear balance organ) dysfunction. The proposed mechanism is disturbance to balance and position sense by noise and/or vibration, especially low frequency components of the noise and vibration.

6) An extensive review of recent medical literature reveals how balance-related neural signals affect a variety of brain areas and functions, including spatial awareness, spatial memory, spatial problem-solving, fear, anxiety, autonomic functions (such as nausea and heart rate), and aversive learning. These known neural relationships provide a robust anatomic and physiologic framework for Wind Turbine Syndrome.

7) Medical and technical literature on the resonance of sound or vibration within body cavities (chest, skull, eyes, throat, ears) is reviewed, because study subjects experience these effects.

8) Published studies of documented low-frequency noise exposure (both experimental and environmental) are reviewed. These demonstrate effects on people similar or identical to Wind Turbine Syndrome. A study from Germany in 1996 may indeed be Wind Turbine Syndrome.

9) Recent mail-in survey studies of people who live near wind turbines in Sweden and the Netherlands show that people are severely annoyed at noise from wind turbines at much lower A-weighted noise levels than for traffic, train, or aircraft noise.

10) Published literature documenting the effects of environmental noise on cardiovascular health and children's learning are reviewed. For health reasons, the World Health Organization recommends lower thresholds for nighttime noise than are currently observed in most countries — especially when the noise has low-frequency components.

11) Wind Turbine Syndrome gives a name and medical description to a set of symptoms severe enough to drive people from their homes, and establishes medical risk factors for such symptoms. This study and other studies reviewed in the report indicate that safe setbacks will be at least 2 km (1.24 miles) and even farther for larger turbines and in more varied topography. Further research is needed to clarify physical causes and physiologic mechanisms, explore other health effects of living near wind turbines, determine how many people are affected, and investigate effects in special populations, including children.

URLs in this post:
[1] the book: http://www.jkselected.com/?page_id=6560

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- Climate change and shifts in endangered species habitat location and migration potential
- Sources, recharge, and loss of groundwater from large-scale solar steam generator systems
- Persistence of endangered, threatened, and unlisted endemic species in current protected areas, and in new areas where habitat suitability is altered from climate and anthropogenic land-use change
- Exotic invasive species migration pathways, competitive abilities and productivity
- Interactions among vegetation composition, production, fire, pollution and climate change
- Carbon budgets and net carbon loss or sequestration.

Unfortunately, many federal and state agencies, as well as several non-government organizations, whose goal is to protect habitats appear to have overlooked previous results suggesting unacceptable levels of "take" for endangered species, and overlooked existing literature addressing net carbon fluxes that would be affected by the proposed solar developments. Nor have they employed state-of-the art research tools capable of integrating new ecosystem and habitat modeling approaches coupled with carefully-collected spatial and temporal data.

Most of the large-scale solar power projects utilize large quantities of water as steam power generators. The largest of these plants are steam-based thermal plants, using up to 2.9 to 3m³/MWh (US DOE 2006). Assuming 12h/day of active use, a 1,000MW would drain 35,280m³/day, or 28.6 acre-feet of water per day, or 10,435 acre-feet/year. One groundwater basin, such as the Palo Verde Mesa Groundwater Basin recharges only 800 acre-feet per year, largely from recharge by underflow from the Chuckwalla Valley (Department of Water Resources 2003). Even with a low water system, with less energy efficiency, the water use may still likely be well more than the recharge rates. The use of water affects agriculture, existing housing and businesses, the mining industry, military training grounds, and wildlife habitats. Plant species, such as the *Amargosa niterwort* (Hasselquist & Allen 2009), and animals including the desert pupfish populations in Ash Meadows (Deacon et al. 2007, Martin 2010) that are dependent upon surface waters and a high groundwater level are once again threatened this time by solar development. Despite the Department of Interior's call that conservation is a high priority, this is not apparent for these developments.

While researchers in the region, including UC Riverside scientists, have been addressing factors that challenge the ability of desert ecosystems to sustain themselves with state-of-the-art analyses, many state and federal agencies have continued to employ outdated models and decision tools [e.g., see "Harness sun wisely" Riverside Press-Enterprise 12/26/2010, and "energy developers need better tortoise counts, officials say" Riverside Press-Enterprise 11/6/10).

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Desert Development Issues

Solar Power in the Desert: Are the current large-scale solar developments really improving California's environment?

Gaps in Desert Research

Michael F. Allen, Director
Professor of Biology, and Plant Pathology and Microbiology

Alan McHughen, Cooperative Extension Specialist
Department of Botany and Plant Sciences

California deserts are faced with unprecedented anthropogenic change. Impact factors range from expanding urban centers and military bases, to potential significant habitat loss from solar and thermal power expansions (including ground water exploitation and depletion beyond recovery, land stripping for power generation units, and fragmentation from power and associated transportation corridors), and climate change. Together these factors threaten remaining suitable habitat for endangered and for other endemic desert species. Other individuals and studies have commented on the use of out-moded technologies employed in the current American Recovery and Reinvestment Act of 2009 (ARRA) projects, and the economic subsidies that are enabling individual site development and the creation of new transmission corridors in remote, previously undisturbed, areas rather than focusing on existing degraded lands and power corridors. We want to be clear that although we question the current project implementation in this article, we strongly support a transition from a fossil-fuel based energy system to one that will not further exacerbate our current trajectories of anthropogenic climate change, as well as providing energy independence and economic stimulus for our country.

Our goal here is to outline the scope of environmental changes that are underway, and to outline research needs necessary to provide long-term sustainability of federally- and state-listed species and their habitats, ensuring that energy developments are also fully compliant with the letter and intent of state and federal resource protection statutes. We identified several topic areas that are of concern to land managers and project developers in the California deserts. These represent topic areas badly in need of research using state-of-the-art techniques coupled with known expertise, tailored to the desert areas to be impacted by the proposed developments. These include the following issues and their interactions:

Federally-listed species such as the desert tortoise and those of concern like the Mohave fringe-toed lizard (Fig 1) are already impacted by new energy developments (e.g., the Ivanpah bulldozing of prime tortoise habitat), roads and urbanization, invasive plants, and changes in military base activities. Relocating species like the tortoises to unoccupied habitats, even those postulated "suitable" by experts, is conceptually flawed. Over 50 percent mortality is reported in short-term experiments (Desert Tortoise Council 2010). If environmental factors like climate change is included, the potential habitat in the desert is reduced even further (Fig 2).

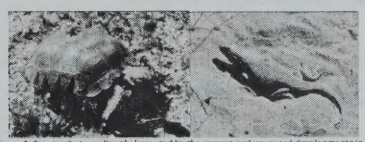

Figure 1. Species that are directly impacted by the current and proposed developments in the California deserts, include the desert tortoise (a federally-listed endangered species) and the Mojave fringe-toed lizard (local populations are of concern to ecologists) (photographs by Cameron Barrows).

Figure 2. Potential response of desert tortoise to projected climate change at Joshua Tree National Park (C. Barrows). The white plus brown areas represents current habitat. White is the area lost with a 1°C increase in temperature, and a 75mm drop in precipitation, with the brown showing the remaining habitat. Transplanting animals, such as the desert tortoise is conceptually suspect, and the data presented to date suggest that this is not a viable approach. Even if accepted, "unoccupied" habitats are both currently suspect, and certainly have not been vetted against future climate change.

Solar development is essential to reduce carbon inputs to the atmosphere and global warming. But solar development needs to incorporate the best available science into planning and production efforts. The proposed large scale solar developments in California will impact dramatically current habitat and potential habitat of species of concern. We already understand that development patterns can dramatically affect current and potential habitat, as published for the Coachella Valley fringe-toed

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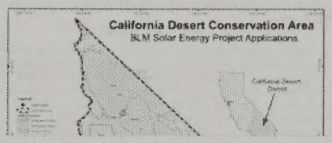
lizard (Barrows et al. 2010). Coupling climate change and development impacts could easily lead to local extinction for many populations of these species, and even extinction in some cases (Barrows et al. 2010).

Infrastructure and transportation associated with urban expansion and energy development is likely to impact significantly desert environmental quality. Almost all areas outside of the National Parks, and the existing military bases are among areas potentially subject to these developments (Fig 3). A decade ago, we demonstrated that in developed areas, such as along highway 62, nitrogen in the



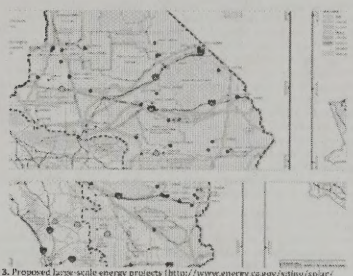


Figure 3. Proposed large-scale energy projects [http://www.energy.ca.gov/siting/solar/cdd_energy_points_8_5x11_solar.pdf]. These areas will be subject to increased habitat fragmentation, vehicular traffic and development resulting in significantly increased air pollution, and N deposition.

soil accumulated during the dry season from vehicular-derived air pollution (Fig 4, M. Allen unpublished data). These soil depositions functioned as fertilizer and were subsequently leached and absorbed by vegetation during the wet season, contributing to the massive increase in exotic grass production, to a level capable of carrying fire (Rao et al. 2010). Regional nitrogen deposition models (Fig 5) show that the military bases and solar developments are in locations undergoing increasing air pollution, threatening endangered species and land management protocols. Continued disregard of these changes likely will have dramatic impacts on the natural resource management issues of the region.

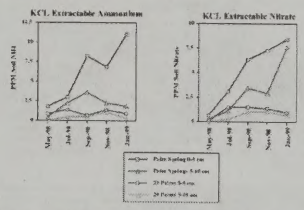


Figure 4. N changes in soil in response to development activity (M Allen unpublished data) showing seasonal increase in N in a developed area (near Palm Desert) versus a remote site (29 Palms Marine Corps base) in 1998. As the Yucca Valley and other desert regions continue to develop, and new energy developments are placed, the potential for more problems with N deposition, fire, and invasive species continues to grow.

Many of the areas that are proposed to be developed for the solar development include Microphyll woodlands (Fig 6). The dominant plants (legume trees) have deep roots capable of reaching groundwater (several meters). When desert plants grow, they absorb carbon dioxide (CO_2). The carbon (C), as sugars, moves into roots and soil organisms. Carbon dioxide is respired back into the soil, part of which reacts with calcium (Ca) in the soil to form calcium carbonate. This is how our deserts sequester large amounts of C and thus function to reduce atmospheric CO_2. ***The magnitude of this carbon storage process is still a crucial research question and remains unknown for our California deserts.*** However, values of up to 100g/m2/y of C-fixation are reported for deserts in Baja and Nevada (Serrano-Ortiz et al. 2010). After vegetation is removed to make

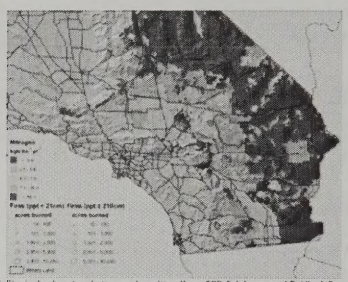


Figure 5. Fire in the desert and nitrogen deposition (from CCB, R. Johnson and E. Allen). Research in the Mojave desert (Allen et al. 2010) shows that in these regions, N deposition (largely from transportation and suburban development) above 3-9 kg/ha/y is above the "critical load" that facilitates exotic grass production, can result in fire and permanent ecosystem degradation. As development increases surrounding these areas, the potential for invasive species, land degradation, and risk of fire increases as it has in other developing areas.

Figure 6. Microphyll woodlands are among the most productive ecosystems that will be affected by solar power facilities. There are no data documenting the amount of carbon sequestration that will be lost with the loss of these stands. However, because these stands access groundwater, they are among the most productive of desert ecosystems.

way for solar arrays, carbon dioxide will be left to return to the atmosphere that ordinarily would have been used to form soil organic matter buried up to several meters deep, or released by roots and soil microbes as soil CO_2, which in turn, binds with soil Ca to form caliche.

Our deserts have large amounts of CO_2 stored as caliche ($CaCO_3$). The amount of C in caliche, when accounted globally, may be equal to the entire C as CO_2 in the atmosphere. This caliche is formed from weathering of Ca in desert soils binding to carbonates that originate in large part from respiration of roots and soil organisms. Most of the caliche in our deserts was formed during the ice ages, when vegetation was more dense and more productive. These deposits likely have been stable since (Schlesinger 1985). Being stable, though, means that inputs equal exports. Carbon in caliche may in fact be released, especially when vegetation and soils are disturbed. Mielnick et al. (2005) reported losses of up to 145g C/m^2/y. Additional research is needed to understand and quantify these exchanges (Schlesinger et al. 2009, Serrano-Ortiz et al. 2010), as there are C exchanges in desert ecosystems that we do not understand. This loss may be especially critical following removal of the vegetation for thermal solar power units. The net C loss due to a loss of native desert vegetation could be as high as 50g C/m^2/y plus weathering and dissolution of carbon dioxide from caliche up to 150g/m^2/y for an area of 7,000 acres (a common size for solar plants of 1,000MW). This translates to an annual loss of nearly 6,000 metric tons of C released by caliche, or retained in the atmosphere due to the loss of vegetation. This does not include the land disturbed by transmission corridors and maintenance roads through desert lands.

Solar power units that generate 1,000MW would save nearly 560,000 metric tons of C per year. However, we do not know the life-span of these solar power units. This net loss of caliche could continue or even increase as temperatures warm for centuries or more, given the incredibly large amount stored in our California desert valleys and vegetation recovery following disturbance for developing desert lands can also take a century or more (Fig 7). If we include the C savings from an active use of photovoltaic cells in the locations where demand is heavy (see Warmann and Jenerette 2010), then the entire regional C balance becomes even less weighted toward the large desert thermal developments.

Finally, what is the life-expectancy of a thermal solar energy development? A common presumption is that these extend indefinitely into the future. But water quality is a crucial issue for solar development, because water from both the Colorado River and the groundwater basins of the regions are highly corrosive to the project plumbing. This means additional land disturbance from maintenance and replacement activities, and a reduced lifespan of these solar projects. Given changes in government subsidies, the over-exploitation of groundwater supplies, and the heavy replacement and maintenance costs associated with the corrosive water quality, this may not be a reasonable assumption. Even when plant re-establishment occurs, disturbed lands will be dominated by annual grasses and

forbs with shallow roots instead of deep-rooted shrubs, potentially for a century or more. Soil organic C likely will rapidly cycle back to the atmosphere. We do not know how soil inorganic C behaves. Understanding the lifespans of the solar plants, compared with this long-term slow C balance is a critical need for determining if these solar developments represent a net long-term reduction in greenhouse gases. Does calcium carbonate then weather back into CO_2 with no plants to replenish the soil CO_2? Could large-scale solar developments in our deserts actually increase atmospheric greenhouse gas levels over the next centuries?

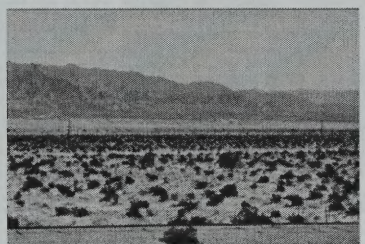


Figure 7. Overlook from Desert Center, CA, looking eastward across lands designated for solar power development. The combination of developments has the potential to fragment populations of desert species, degrade soils, and reduce carbon sequestration potential of these arid lands.

The areas of the California deserts where the mega- solar projects are to be built are mainly in areas where water is the limiting factor for production and organism survival. Precipitation is highly variable in space and time, and hydrology is not well documented. The basins are interconnected. Yet we know little about the rates or even directions of the subsurface flows and small transient perched water pockets created by earthquake fault lines that support plants whose roots must reach the groundwater, such as palms, ironwood and mesquite. Water extraction at large scales could have critical impacts on desert ecosystems, including animal species like deer, bighorn sheep, and mountain lions, more than just tortoises. Microphyll woodlands and mesquite stands support various endangered species and species of concern, both directly as habitat and food, and indirectly by supporting annual forbs that serve as food sources as the soil dries out. We do not know how or where water is connected between basins, nor if the water used for individual projects is continually recharged, or comprised of water laid down in the Pleistocene.

Concluding Remarks

These development impacts are particularly questionable given the incredible surface area located in regions with high solar radiation such as southern California. Warmann and Jenerette (2010) estimated that 10 percent of the rooftop areas suitable for solar photovoltaic systems could supply 80 percent of the annual energy requirements for the region. Given the large acreages of private, already disturbed lands scattered across the California deserts, use of more pristine habitat of endangered species like the desert tortoise and the *Amorgosa niterwort* seems counterproductive.

Again, we are not objecting to renewable energy development in the California deserts. Indeed, we have worked for decades with military installations and with energy companies to enhance environmental management and restoration. We can do the same with renewable energy projects. However, without careful planning and management, massive detrimental impacts over extremely large areas could result from the current energy development proposals. For society to benefit from solar energy while preserving our desert ecosystems, we must obtain and use sound existing scientific methods, and fund credible new science based on accepted review and award principles, as practiced by agencies with experience in peer-reviewed funding such as National Science Foundation or National Institute of Health. We must apply principles as judged by published peer-reviewed literature in top journals, and defendable, innovative ideas judged by scientific experts without conflicts of interest.

If the construction of poorly placed solar arrays in California leads to the loss of endangered species, destruction of plant and animal habitat, increased environmental contaminants, diversion of water and increased global warming due to more carbon dioxide in the atmosphere, then any justification for placing solar arrays in our deserts is seriously undermined.

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Frontiers in Ecology and the Environment

The ecology of dust

Jason P Field, Jayne Belnap, David D Breshears, Jason C Neff, Gregory S Okin, Jeffrey J Whicker, Thomas H Painter, Sujith Ravi, Marith C Reheis, and Richard L Reynolds

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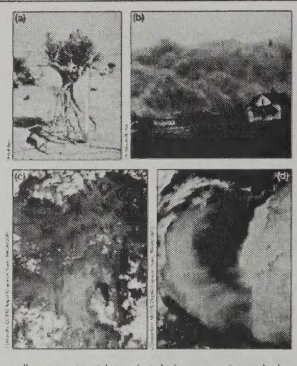

Figure 1. (a) Individual plant scale: shrub with exposed roots following the aftermath of a San Joaquin Valley dust storm in December 1957. (b) Local scale: dust storm approaching Stratford, Texas, April 18, 1935. (c) Regional scale: dust storm (tan puzzle) on July 23, 2003, emanating in the western part of Utah and blowing northeastward over Great Salt Lake. (d) Global scale: dust transport over the Atlantic Ocean, shown here off the west coast of northern Africa on March 2, 2003.

land-use intensification (Okin et al. 2006) could amplify dust emissions from drylands and pose major environmental challenges for land managers and policy makers.

A wind erosion primer

Wind transports soil material through three mechanisms (Figure 2) that are roughly differentiated based on the soil particle diameter (these categories overlap): *suspension* for soil particles (diameters > 500 µm, whereas for diameters ranging from 20–500 µm), and *saltation* for diameters < 20 µm (Bagnold 1941; Tatarko 2001; Gillette and Middleton 2006). All three processes redistribute soil and associated nutrients and organic material at different spatial scales (Field et al. in press). Wind-driven surface creep and saltating particles dominate the mass movement of soil on a local scale (less than several meters; Sterk and Zobeck 2006). In contrast, suspended dust particles can be transported over long distances and can be moved at regional, continental, and even global scales (Chadwick et al. 1999; Prospero et al. 2001; Goudie and Middleton 2006). Most of the horizontal aeolian sediment transport occurs close to the soil surface, decreasing sharply with height (Shao et al. 1993).

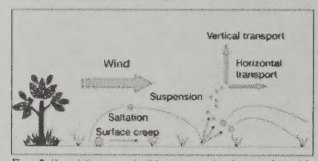

Figure 2. How wind erosion works. Saltation occurs when the shear velocity of the wind exceeds the threshold shear velocity of the soil; suspension of dust-size particles occurs when saltating particles bombard the soil surface, overcoming the strong interparticle forces between dust particles.

A small fraction of this flux can become suspended and thus be available for long-distance dust transport, as reflected in a vertical flux that is laterally relatively homogeneous (Gillette et al. 1997a). Because soil nutrients (eg nitrogen, phosphorous) and organic materials often associated with smaller soil particles, soil fertility in dust source areas becomes depleted while sink areas are concomitantly enriched (Li et al. 2007).

Wind erosion rates and dust emissions at a specific location are influenced by various factors, such as near-surface wind gradients and atmospheric relative humidity (Ono et al. 2003). Wind speed is related to the

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The ecology of dust

Jason P Field[1*], Jayne Belnap[2], David D Breshears[3,4], Jason C Neff[5], Gregory S Okin[6], Jeffrey J Whicker[4], Thomas H Painter[7], Sujith Ravi[8], Marith C Reheis[9], and Richard L Reynolds[9]

Wind erosion and associated dust emissions play a fundamental role in many ecological processes and provide important biogeochemical connectivity at scales from individual plants up to the entire globe. Yet, most ecological studies do not explicitly consider dust-driven processes, perhaps because most relevant research on aeolian (wind-driven) processes has been presented in a geoscience rather than an ecological context. To bridge this disciplinary gap, we provide a general overview of the ecological importance of dust, examine complex interactions between wind erosion and ecosystem dynamics from the scale of plants and surrounding space in regional and global scales, and highlight specific examples of how disturbance affects these interactions and their consequences. It is likely that changes in climate and intensification of land use will lead to increased dust production from many drylands. To address these issues, environmental scientists, land managers, and policy makers need to consider wind erosion and dust emission more explicitly in resource management decisions.

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For many scientists, the only dust they think about is the thin film of material that accumulates on their computer monitors on a regular basis. However, dust has enormous relevance to a wide range of ecological processes and environmental management challenges. Dust is fine particulate material that is removed from the land surface by wind erosion and is small enough to be suspended in the atmosphere (Bagnold 1941; Tsoar et al. 2002). Dust emissions vary with climate, as shown by paleostudies (eg Clark et al. 2002), and also with land use. Perhaps the most notable example of how ecologically important dust can be is the Dust Bowl era of the 1930s in the American Great Plains, which is considered by many experts to be one of the most severe environmental catastrophes in the history of the US (see Peters et al. 2002). The widespread cultivation of marginally arable lands, in combination with a severe regional-scale drought during the 1930s, caused substantial increases in wind erosion rates, resulting in the degradation of roughly 90 million ha of land (Lee et al. 1938) and the loss of nearly 300 million metric tons of topsoil in 1935 alone (Johansen 1942; Hansen and Libecap 2004). This large-scale amplification of wind erosion was the result of stressed fields becoming excessive and uncontrolled (Hansen and Libecap 2004), thereby triggering a threshold response (Peters et al. 2002). The devastating effects of the Dust Bowl were felt nationally and resulted in the formation of the Soil Conservation Service in 1935. However, the important ecological lessons of the Dust Bowl have faded with time, and most ecological studies do not explicitly consider the impact of dust flux and wind erosion. Ironically, the former Soil Conservation Service – now the Natural Resources Conservation Service – has shifted most of its focus to water erosion, and has largely abandoned the problem of windblown erosion (Field et al. in press).

In a nutshell:

- Ecologists and other environmental scientists often overlook the importance of dust and wind-driven processes, yet these processes exert a fundamental influence on biogeochemical and ecological systems
- The importance of these processes operates at scales from individual plants up to global levels
- Because changes in climate and intensification of land use are expected to result in increased dust production, ecologists, land managers, and policy makers need to more explicitly consider wind erosion and dust emission

Environmental scientists are increasingly recognizing dust as both a major environmental driver and a source of uncertainty for climate models (Tegen and Dubovik 2006; Neff et al. 2008). Wind erosion and dust emission can cause substantial impacts, not only to human health (eg through respiratory problems), but also to basic ecosystem processes, at scales ranging from individual plants or even smaller (Figure 1d) up through local and regional scales (Figure 1b, c) to a global scale (Figure 1d), representing biogeochemical connectivity across continents (Peters et al. 2002; Okin et al. 2009).

Here, we provide a primer on the importance of aeolian (wind-driven) processes associated with wind erosion, at

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amount of energy available to move sediment, and much aeolian research focuses on the "threshold friction velocity" – wind speed at which particles of a given size under a given set of field conditions begin to detach from the soil surface (Gillette et al. 1980). Atmospheric relative humidity, coarse soil moisture at the soil surface, especially in arid and semi-arid regions during fallow periods (Ravi et al. 2004), because soil moisture in particles at the soil surface is typically at equilibrium with atmospheric moisture. This is important, because soil moisture influences the interparticle forces that, in turn, influence the threshold velocity, resulting in a clear, but complex, relationship between atmospheric relative humidity, particle size, and soil erodibility (Ravi et al. 2004). Wind erosion may be ineffective with wind speeds, although few studies have specifically addressed this issue (Field et al. in press). Collectively, these complex relationships need to be considered in terms of their relative role in affecting aeolian processes at all scales.

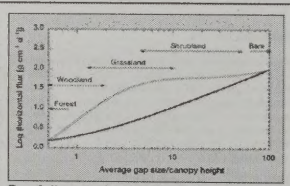

Figure 3. Hypothesized aeolian sediment flux as a function of the ratio of average unvegetated gap size to plant height. The black line indicates how sand flux in the presence of an undisturbed herbaceous layer for each ecosystem. As gaps (or disturbance) that might vary in the presence of a disturbance that removed most of the herbaceous layer. Flux rates are calculated for realistic wind conditions in south central New Mexico. Flux rates are calculated for a wind shear velocity of 40 cm s^{-1}, and a stress layer soil with a threshold shear velocity of 24 cm s^{-1} as assumed. Woodland applies to lands that have a mix of small vegetation mats and open spaces. Adapted from Okin (2005) and Breshears et al. (2009).

Plant-interspace scale

At the plant-interspace scale, which includes the area between as well as beneath individual plants, aeolian transport is a major abiotic mechanism for moving material both within and out of environments with discontinuous cover. The chemistry of the soil surface, and thus the potential impacts of aeolian processes at the plant-interspace scale, depend on both the chemistry of the soil surface to resist erosion and the ability of the wind to reach the soil surface. Erosion resistance is determined by the strength of the soil and the presence of surface protection, such as rocks, plant litter, and physical and biological soil crusts (Gillette et al. 1982; Okin et al. 2006). Rocks and plant litter too large to be moved by wind offer the greatest soil protection. Physical soil crusts – created by the binding together of silt and clay particles when wetted and then dried – protect soils except when crusts are subjected to disturbance. Unlike disturbed, these soils have an inherently higher resistance to erosion than soils dominated by coarser sand particles. Biological soil crusts, composed of cyanobacteria, lichens, and moss, stabilize soils by enzyming and digesting material that binds soil surface particles together, thereby increasing soil aggregate size and increasing soil resistance to the shearing forces of wind (Belnap and Gillette 1997).

The type, cover, and arrangement of vegetation have the strongest influence on the ability of the wind to reach the soil surface. The patchy and dynamic nature of vegetation in dryland regions results in aeolian transport being highly heterogeneous in both space and time. The amount of material that is moved depends on the size of unvegetated gaps upon which the wind can act (generally excluding rocky or gravelly areas, referred to as desert pavement, and areas covered by physical or biological soil crust) and the height and density of the vegetation, which controls the size of the protected area downwind of individual plants (Breshears et al. 2009). Although surface characteristics are important, the amount of horizontal flux depends largely on the structure of the ecosystem and the degree of connectivity between unvegetated gaps (Okin et al. 2009; Figure 3). Unvegetated areas immediately downwind of vegetation (within 5–10 times the height of an individual plant) are relatively protected from the erosive forces of the wind by the plant. In contrast, unvegetated areas farther downwind from a plant do not experience the same degree of protection from erosion (Okin 2008). This disparity leads to heterogeneous erosion and the net movement of soil and later from unvegetated gaps and concentration of those resources beneath plant canopies. Substrate-soil particles are concentrated in protected areas beneath plant canopies, giving rise to coppice dunes in extreme circumstances, such as with environments that have sparse vegetation cover and easily erodible soil. Because saltating material comes most of the time and momentum, it can have considerable physical effects on existing vegetation, including burial, exposure of belowground plant tissue (debarking), abrasion of plant tissue, and leaf stripping. This has been shown to indirectly lead to reduced plant growth and mortality, and to contribute to rapid changes in ecosystem structure, for instance a rapid change from grassland to shrubland (Okin et al. 2006).

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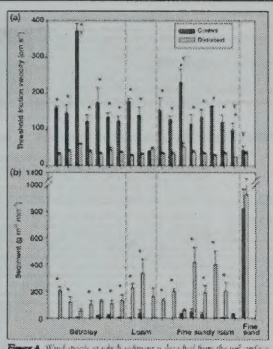

Figure 4. *Wind speeds at which sediment is detached from the soil surface (TFV). This, a higher value denotes greater soil stability. (b) The horizontal aeolian sediment flux, thus, a higher value denotes lower soil stability and greater sediment production. Error bars represent ± SE. Asterisks indicate statistical differences ($P < 0.05$). "0" indicates that wind speeds generated by the natural wind tunnels do change the soil surface in the control (silty) dust, reported values are conservative.*

Finer particles injured by wind – including silt- and clay-sized particles – contain most of the cation-exchange capacity, water holding capacity, and fertility of the soil (Tow et al. 2002). Some of these finer particles are trapped by local vegetation (Raupach et al. 2001) and, combined with a similar mechanism for water erosion, contribute to the formation of fertile islands found throughout dryland regions (Schlesinger et al. 1990). In addition, fine particles and associated nutrients are added locally by infiltration through gravelly surfaces (Reheis et al. 2005). However, many of these finer soil particles are eventually lost from the local system due to wind erosion (Gillette 1974), resulting in local depletion of soil fertility and water-holding capacity (Li et al. 2007, 2008). The relative depletion of fine particles at the surface may not have immediate impacts on existing vegetation, because the effect is concentrated above the root zone; the implications of this depletion for vegetation establishment, however, are striking, because of the heavy reliance of germinants on soil resources and water in the uppermost soil layers.

Many of the factors that drive wind erosion are, of course, greatly affected by soil surface disturbances. Grazing cattle, crush biological and physical soil crusts and decrease vegetative cover (Nash et al. 2000), thereby increasing wind erosion (eg Neff et al. 2005). Offroad vehicles and military training activities also crush vegetation and impact plant-interspace surface characteristics, particularly biological and physical soil crusts (Belnap and Gillette 1997; Prochnow et al. 2009; Figure 4). Fire can dramatically increase wind erosion (Whicker et al. 2002; Prochnow et al. 2009), although fire may be less generally extensive than grazing and recreational use. Burning vegetation leaves bi ngacid rangeland fires) releases different amounts of organic compounds, which in turn, lead to different levels of water repellency in the soil, depending on various factors, such as vegetation type, soil properties, and fire intensity and duration (DeBano 2000). Fire-induced water repellency decreases the strength of interparticle soil-binding forces by increasing the soil-water contact angle. This repellency enhances soil erodibility by causing a drop in threshold friction velocity, thereby increasing post-fire erosion (Whicker et al. 2002; Ravi et al. 2007).

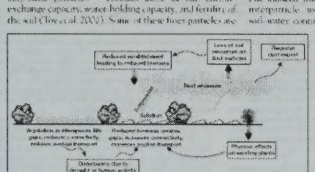

Figure 5. *Primary feedbacks between vegetation formation, wind erosion and transport structure.*

There are important feedbacks between the vegetation and aeolian flux in deserts (Figure 5). Aeolian flux controls the redistribution of sediment and the loss of dust and dust-borne nutrients, thus affecting the amount and distribution of vegetation on the bird surface. The amount and distribution of vegetation, in turn, affect the degree and spatial patterns of aeolian flux. This feedback can occur in most environments, including those arid relatively high vegetation cover, and is responsible for ecosystem thresholds (Whicker et al. 2002; Ravi et al. 2007).

We think, human use of dryland regions, which comprise almost 41% of the terrestrial land surface, is increasing dramatically. Currently, over 2 billion people depend on drylands for habitation and food (MA 2005), and much of the global population growth is occurring in these water-limited landscapes (Reynolds et al. 2007). For example, human populations in southern Arizona and California are expected to grow from 25 million to 35 million over the next 15 years (Tuthmary et al. 2005). An increase in human settlement size of these landscapes will be accompanied by a further loss in the protective covering of plants, plant litter, and physical and biological soil crusts, thereby amplifying dust emissions from the disturbed surfaces. Offroad recreational activity in southern California has risen from virtually zero in 1960 to almost 10 million user-days in 2006 (Bureau of Land Management RIMS database). It now drives 52 km per day, this specific activity alone, in this relatively small region, can generate as much as 2.7 metric tons of dust per year (Ehrk and Stukel 1979; Forman et al. 2003). The ever-exploding exploration and development of energy resources (including wind and solar) in dryland regions are also of concern. All of these activities will result in the loss of vegetation and soil surface protection (eg scraping away vegetation for solar farms and oil pads), increased offroad vehicle traffic, pipelines, transmission lines, and greatly increased traffic on existing and newly established dirt roads. The demand for water will also be increasing in these regions – demands that result in water diversions or the pumping of water from shallow lakes, often drying them completely (eg Lake Aibi in China, Aral Sea in Uzbekistan, Owens Lake in US), or from shallow aquifers, which may lead to the death of vegetation (Hinzman et al. 2003). These activities can have cost exposures of soils highly vulnerable to wind erosion. An example of the influence of dust from hydric sediments on vegetation is provided by Blank et al. (1999), who found that dust from playas (dry or ephemeral lake beds), which are rich in nutrients and other nutrients, stimulated the increase of a playa-margin, dune-invaded landscape by weeds (such as *Salsola paulsenii*).

The conversion of perennial plant communities to those dominated by annual plants is also increasing glob-

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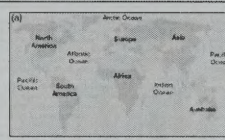
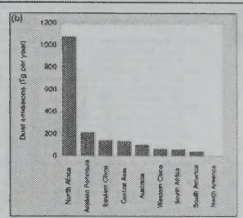


Figure 7. *Map showing global distribution of (a) drylands and (b) their respective dust emissions by region. Tg = teragram. Modified from Tanaka and Chiba (2006).*

ing (Prospero et al. 2002). In South America, human land use of semiarid regions for grazing also appears to have increased dust deposition rates in the 20th century, relative to those of the 19th century (McGlynn et al. 2004). The human role in dust emission and deposition may be limited at the global scale, but at local to regional scales, dust appears to be mostly a byproduct of human land-use decisions. In this way, humans may be indirectly responsible for potentially large, but poorly understood, perturbations to local, regional, and global hydrologic, and biogeochemical cycling.



■ Projections and implications

The future will bring many environmental changes to dryland areas; these will act independently and synergistically to affect dust fluxes at the local, regional, and global scales. Projected climatic changes include a global increase in temperatures (Seager et al. 2007) in concert with a range of future precipitation possibilities for drylands. This could include greater up in some areas, but most regions are more likely to experience a small decrease in precipitation. By 2050, increased evaporative drive is expected to decrease average soil moisture conditions in the southwestern US (Seager et al. 2007) to levels below those experienced during the most severe droughts of this century, including the Dust Bowl years (Fulbright et al. 2005). Such declines in soil moisture will probably result in a reduction in the protective vegetative cover, a slower recovery from disturbance, and an increase in dust emission from exposed soil. Lower soil moisture will also mean that fuels that burn more readily – wildfires in the western US are projected to increase substantially in both frequency and intensity (Westerling et al. 2006), which will also increase exposed soils and the hydrophobicity of these soils, thus amplifying dust emissions (Whicker et al. 2002; Ravi et al. 2007).

We think, human use of dryland regions, which comprise almost 41% of the terrestrial land surface, is increasing dramatically. Currently, over 2 billion people depend on drylands for habitation and food (MA 2005), and much of the global population growth is occurring in these

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for cascading landdegradation phenomena caused by local or regional disturbance events (Peters et al. 2007). At the same time, dust-emitting desert regions, particularly those that have experienced substantial disturbance, can have critical consequences for downwind ecosystems.

■ Regional- to global-scale consequences

The regional and global transport of dust plays many biogeochemical roles in the Earth system. Dust has an important, yet relatively poorly quantified, influence on climate at both regional and global scales. At regional scales, dust can have a substantial effect on the atmospheric radiative balance and the concentration of condensation nuclei, both of which can influence climate variability via effects on surface temperatures and precipitation patterns (Yoshioka et al. 2007). Dust deposited on mountain snowpack can have an indirect effect on climate through the snow-albedo feedback (Painter et al. 2007; Skiles et al. 2009; Figure 6). Dust deposition snow affects, removing snow cover earlier and revealing a markedly darker land surface that absorbs solar radiation and contributes to the atmosphere.

The triggering of earlier and faster snowmelt by dust can potentially result in less total and less late-season water supplies in areas where seasonal water scarcity occurs.

In addition to its effects on climate, dust plays an important role in the control of regional and global biogeochemical cycles and dispersal of pathogens. At the global scale, nutrient additions by dust may have stimulated the productivity of oceanic plankton over glacial time scales, thus accelerating the uptake of atmospheric CO_2 (eg Ridgwell et al. 2003). At the regional scale, there have been several studies examining the impact of dust deposition on terrestrial and aquatic nutrient cycling. In tropical ecosystems with a long legacy of chemical weathering and depletion of soil base cations and phosphorus, dust has been suggested as a major nutrient source. For example, the transport of Saharan dust to the Amazon basin has played an important role in offsetting the losses of bedrock-derived nutrients to leaching (Koren et al. 2006). Similar studies in Hawai'i suggest that dust is responsible for supplying essential plant elements to heavily weathered soils (Chadwick et al. 1999). There is mounting evidence that dust transport and deposition are important to temperate ecosystems as well. Transport of minerals, phosphorus, and other nutrients by dust can be substantial (Neff et al. 2008), and the subsequent deposition of these nutrients may influence both terrestrial and aquatic ecosystems. In stable soil surfaces on the Colorado Plateau, dust accumulation in soils has increased the stocks of all macro- and micronutrients, especially phosphorus and magnesium (Reynolds et al. 2006).

Figure 6. *Dust falls in snow on Mount Sopris, Colorado, May 2007.*

Long-term dust accumulation can lead to the development of loess soils (constructed wind-blown silt deposits) in some regions, such as the American Midwest, providing for fertile agriculture (Pye 1987). These studies illustrate the role that dust is an important and underappreciated component of contemporary biogeochemical cycles.

The importance of dust to global biogeochemical cycles raises several questions about the magnitude, distribution, and variation in dust fluxes over the Earth, that has led to numerous attempts to quantify the contributions of dust sources around the globe. Dust from land disturbed by humans or extreme climatic events, such as drought, may contribute a substantial fraction – perhaps one-third to one-half – of the total atmospheric dust loading (Tegen and Fung 1995). Model assessments indicate that global fluxes are dominated by the large deserts of North Africa, Asia, and the Middle East (Tanaka and Chiba 2006). This global emission flux appears to be dominated by non-arctic, lightland regions, with large intercontinental variation in dust fluxes controlled primarily by climate (Figure 7).

Dust emissions from semi-arid lands and drylands appear to be more heavily influenced by human land use. In the semi-arid regions of China, for instance, there is evidence that wind erosion of soils is influenced by grazing activities (eg Liu et al. 2003), and in South and North America, ice and sediment core records reveal that human activity has increased dust deposition over the past 100–200 years. In the western US, lake sediment records from the San Juan Mountains of Colorado show that dust loading reached a peak of ~ 300% of background (late Holocene) deposition since 1900, when settlement and widespread livestock grazing dramatically increased (Neff et al. 2008). Abandoned cotton fields in Texas and California massively produce large regional dust storms that can be seen on satellite imagery

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ally, mostly as a result of the abandonment of agricultural fields, overgrazing, and other soil surface disturbing activities (D'Antonio and Vitousek 1992). In wet years, the annual cover is sufficient to stabilize soils and may even exceed the protection offered by the perennial community. However, in dry years, these annual grasses do not germinate, or die shortly after germination, leaving soils barren and vulnerable to erosion. Dominance by annual plants also accelerates fire cycles. In wet years, these grasses produce sufficient continuous fuels to promote fire in the dry years that follow, leaving post-fire soils vulnerable to erosion.

Dust responses can become synergistic with changes in climate and land use when one or more of the above factors coincide in time or space. For instance, offroad vehicle use leads to decreases in plant biomass and cover, as a result of direct impacts to vegetation and crushing of nearby plants (Munzi et al. 1989). When these impacts occur during times of reduced soil moisture, the reduction in plant cover is even greater, allowing for increased erosion. Another synergistic series of effects can occur on landscapes where perennial plants have been replaced by annual plants. When these surfaces are then disturbed by livestock or vehicles, an exponential increase in soil loss can be observed (Belnap 1995). These studies illustrate the integrated but unrecognized landscape (Belnap et al. in press).

In summary, greater dust emissions, including more frequent and larger dust storms, are likely to occur from dryland regions as temperatures increase and more dryland areas are trampled, cleared of vegetation, plowed, and/or converted from perennial to annual plants. These increasing elements will result in degraded soils and plants or the dust source, as well as in impacts to humans and ecosystem health during transport and at deposition points. Avoiding the potentially severe consequences of this future scenario will require a new approach to the management of dryland regions. We need to identify the chronic and acute sources of dust that have potentially large impacts at local, regional, and global scales (Peters et al. 2007). We also need to better understand how the timing, type, and intensity of different land uses affect dust production. The overarching challenge for ecologists and other environmental scientists, land managers, and policy makers will be to work together to manage vulnerable areas in ways that reduce excess dust production to the fullest extent possible (Okin et al. 2004).

■ Acknowledgements

We thank KA Fergason, DJ Lane, CJ Perry, and SL Phillips for comments on the manuscript. This work was supported by the US Department of Agriculture Cooperative State Research, Education, and Extension Service (CSREES 2005-38420-15859), the National Science Foundation (NSF DEB-0216462, DEB-0614230, DEB-0823255, EAR-0720211), and the Global Change Program of the US Geological Survey.

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of death by state were examined. Most rates were calculated by state for urban and rural residence for whites only in 1940 deaths, since complete racial data was available by urban/rural residence by state for only 13 of 48 states. Data was available for 46 states in the 1940 mortality tabulations. (District of Columbia was excluded because it was primarily an urban population. Excel graphing software [11] and 'Create a Graph' [12] software was used.

I had hoped to further test this hypothesis by studying mortality in individual US farms with and without electrification, when the 1930 US census 70 year quarantine expired in 2000. Unfortunately, the 1940 US farm census schedules had been destroyed.

Findings

Rural residential electrification did not reach urban levels until 1956 (Table 1). Table 2 shows the level of residential electrification for each state for 1930 and 1940. In 1930 and 1940 only 9.5% and 13%, respectively, of all generated electricity was used in residences. Most electricity was used in commercial and industrial applications.

Figs. 1–4 were copied and scanned from 'Vital statistics rates in the United States 1940–1960', by Robert Grove Ph.D. and Alice M. Hetzel. This volume was published in 1968. Fig. 1 shows a gradual decline in the all causes death rate from 1900 to 1960 except for a spike caused by the 1918 influenza pandemic. Death rates due to tuberculosis, typhoid fever, diphtheria, dysentery, influenza and pneumonia and measles all fell sharply in this period, and account for most of the decline in the all causes death rate. Figs. 2–4 show that in the same time period when the all causes death rate was declining, all malignant neoplasms (Fig. 2), cerebrovascular diseases (Fig. 3), and diabetes (Fig. 4) all had gradually increasing death rates. In 1900, heart disease and cancer were 4th and 8th in a list of 10 leading causes of death. By 1940 heart disease had risen to first and cancer to second place, and have maintained that position ever since. Table 3 shows that for all major causes of death examined, except motor vehicle accidents, there was a sizable urban excess in 1940 deaths. The authors of the extensive 691 page introduction to the 1930 mortality statistics volume noted that the cancer rates for cities were 58.2% higher than those for rural areas. They speculated that some of this excess might have been due to rural residents dying in urban hospitals. In 1940 deaths by place of residence and occurrence are presented in separate volumes. In 1940 only 2.1% of all deaths occurred to residents of one state dying in another state. Most non-resident deaths were residents of other areas of the same state. Table 4 presents correlation coefficients for the relationship between death rates by urban/rural areas of each state and the percent of residences in each state with

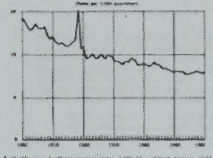

Fig. 1. Death rates: death registration states, 1900–32, and United States, 1933–60.

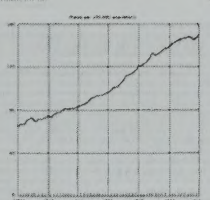

Fig. 2. Death rates for malignant neoplasms: death registration states, 1900–32, and United States, 1933–60.

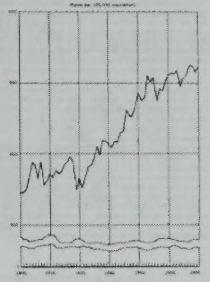

Fig. 3. Death rates for major cerebrovascular renal diseases: death registration states, 1900–32, and United States, 1933–60.

electric service. In 1940 urban and rural residence information was not available for individual cancers as it was in 1930, but death rates for each cancer were available by state. They were used to calculate correlations between electric service by state and respiratory cancer, breast cancer and leukemia mortality.

All causes of death

There was no correlation between residential electrification and total death rate for urban areas, but there was a significant

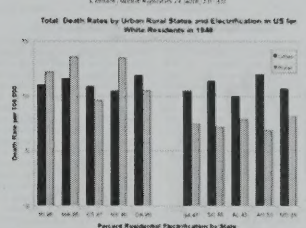

Fig. 5. All causes death rates by urban rural status and electrification in the US for white residents in 1940.

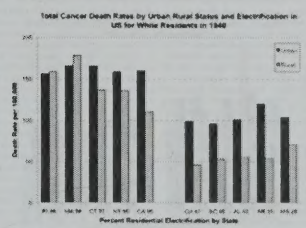

Fig. 6. Total cancer death rates by urban rural status and electrification in the US for white residents in 1940.

Respiratory cancer

No urban rural information was available for respiratory cancer, but the correlation between residential electrification and state death rates was $r = 0.611$; $p = <0.0001$. This cancer is etiologically strongly related to cigarette smoking, so the correlation with electrification is surprising. A large electrical utility worker cohort study found a high respiratory cancer incidence related to high frequency EMF transient exposure independent of cigarette smoking with a significant dose–response relationship [13].

Breast cancer

Although urban/rural information was not available for breast cancer, the 1940 state breast cancer death rates have a correlation of $r = 0.794$; $p = <0.0001$ with residential electrification. Fig. 8 shows the typical time trend of breast cancer death rates for a state with a high level of electrification (96%) and one with a low level of electrification (<50% in 1940). The Oklahoma breast cancer death rate increased from 1920 to 1940, and then gradually decreased until 1960. The Tennessee breast cancer death rate is less than half of the California rate in 1920 and continues a steady increase until 1960.

Diabetes

This cause has a MF urban excess. In spite of this, the correlation coefficients for urban and rural areas are similar at $r = 0.68$; $p = <0.0001$. There is some animal and human evidence that EMFs can effect insulin production and blood glucose levels [16]. Fig. 9

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correlation for rural areas ($r = 0.650$, $p = <0.0001$). Fig. 5 shows the 1940 resident white death rates for urban and rural areas of states

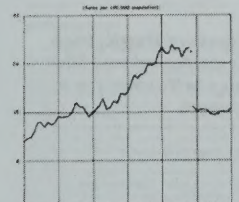

Fig. 4. Cross rates for diabetes mellitus: death registration states, 1900–32, and United States, 1933–50.

Table 3
Table 3. White resident death rates per 100,000 by urban and rural residence.

Cause of death	ICD No.[a]	Urban rate	Rural rate	Urban/Rural excess
All	1–200	1111.1	829.3	34.0
All cancers	45–55	195.8	91.7	39.2
Coronary disease	96	324.1	69.1	33.7
Other diseases of heart	90–93 (Males) 90–92 (Fem.)	213.4	163.0	30.8
Diabetes	61	13.2	10.0	46.0
Suicide	163–164	17.1	13.2	29.5
Motor vehicle accidents	139	24.6	26.2	−6.1

[a] 1940 International Classification of Diseases.

Table 4
Correlation coefficients for 1940 white US death rates by state by electrification or white resident death.

Cancer	ICD No.[a]	Residence	r	p (for table)	Slope	Intercept
All causes	1–200	Urban	0.063	0.681	0.264	1113.6
		Rural	0.078	0.604	0.240	811.4
All cancers	45–55	Urban	0.662	<0.0001	0.861	95.506
		Rural	0.750	<0.0001	0.387	59.959
Respiratory cancer[b]	47	Male	0.611	<0.0001	0.615	39.06
Breast cancer female	50	State	0.794	<0.0001	0.139	−1.585
Diabetes	61	Urban	0.666	<0.0001	0.218	8.966
		Rural	0.654	<0.0001	0.496	−4.154
Leukemia[c]	204	State	0.378	0.0040	0.0451	6.005
Coronary artery	96	Urban	0.466	0.0010	0.0823	83.290
disease		Rural	0.783	0.0000	0.0000	23.378
Other diseases of the heart	90–93 (Males) 90–92 (Fem.)	Urban	0.438	0.002	0.268	180.93
		Rural	0.598	0.020	0.0000	28.02
Suicide	163–4	Urban	0.077	0.606	0.2991	10.428
		Rural	0.179	0.232	0.0000	8.290
Motor vehicle	139	Urban	−0.274	0.056	0.0000	−0.1471
Accidents		Rural	0.251	0.263	0.0000	17.280

[a] International Classification of Diseases 1938 revision.
[b] Age adjusted death rate (with urban).

having greater than 90% of residences electrified and states having less than 50% of residences electrified. In the highly electrified states, urban and rural death rates were similar, but in low electrification states, the urban death rates were systematically higher than the rural death rates. The urban death rates were similar in both high and low electrification states.

All malignant neoplasms

In 1940, the urban total cancer rate was 40.2% higher than the rural rate. Both urban and rural cancer deaths rates were significantly correlated with residential electrification. Fig. 6 shows the 1940 resident white total cancer rates for urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. Four of the five high electrification states had similar urban and rural total cancer rates, while all the low electrification states had urban rates about twice as high as rural rates. Both urban and rural cancer rates were lower in low electrification states than in high electrification states. Fig. 7 shows the time trend of the total cancer rate between 1920 and 1960 for Massachusetts (1940 electrification rate = 97.6%) and Louisiana (1940 electrification rate = 48.9%). The Massachusetts cancer rate was about twice that of Louisiana between 1920 and 1945. The Massachusetts rate leveled off in 1945, but the Louisiana rate increased steadily between 1920 and 1960. A declining urban–rural gradient for cancer is still evident in 1960–1990 US cancer incidence data [17]. Swedish investigators [14] have reported increasing cancer mortality and incidence time trends mostly in the latter half of the 20th century.

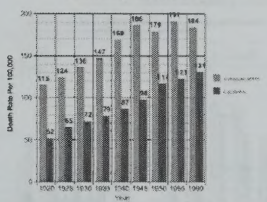

Fig. 7. US white resident total cancer death rates for Massachusetts (1940 electrification = 97.6%) and Louisiana (1940 electrification = 48.9%) 1920–1960.

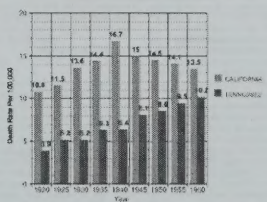

Fig. 8. US white resident breast cancer death rates for California (96% electrified) and Tennessee (36% electrified) by year.

shows that in states with low levels of electrification in 1940, the urban diabetes death rates are consistently higher than the rural rates, but are always lower than the urban and rural rates in the high electrification states.

Leukemia

Since the childhood leukemia age peak is strongly associated with residential electrification, it was interesting that the all leukemia death rate correlation was $r = 0.375$; $p = 0.0042$. Most of these deaths are in adults and are of different types of leukemia. A study of acutrue ratio operators showed a sole/free excess only of acute myelogenous leukemia [17].

Coronary artery disease and other heart disease

These two cause groups had the same percentage urban excess (38%), and very similar patterns of urban and rural correlation coefficients with residential electrification. The urban correlations were about $r = 0.4$ and rural deaths had correlations of 0.78 and 0.78 respectively. Fig. 10 shows the 1940 resident white coronary artery disease death rates for urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. Four of the five high electrification states had similar urban and rural total cancer rates, while all the low electrification states had urban rates about twice as high as rural rates. Urban and rural coronary artery death rates were lower in low electrification states than in high electrification states.

Suicide

The urban suicide death rate is about 30% higher than the rural rate. The urban suicide rate is not correlated with residential electrification ($r = 0.077$; $p = 0.200$), but the rural death rate is correlated with 1940 state residential electrification levels ($r = 0.729$; $p = <0.0001$). Fig. 11 shows the 1940 resident white suicide for

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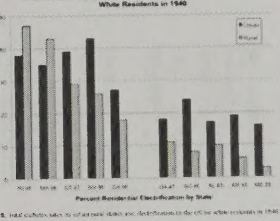

Fig. 9. Total diabetes rates by urban rural status and electrification in the US for white residents in 1940.

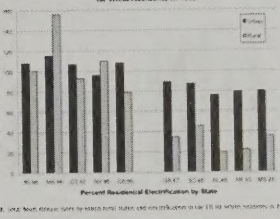

Fig. 10. Total heart disease rates by urban rural status and electrification in the US for white residents in 1940.

urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. In four of five built electrification states, rural suicide rates are higher than the urban rates. In all of the low electrification states, the urban rate is higher. The rural rates in the high electrification states are higher than the rural rates in the low electrification states. Fig. 12 shows X, Y scatter plots for urban and rural suicide by electrification for 48 states. Suicide has been associated with both residential [10] and occupational [10] EMF exposure. Suicide is probably the visible peak of the clinical depression iceberg.

Motor vehicle accidents

Although the mortality rates are similar in urban and rural areas, the correlations with residential electrification levels are different. There is a slight negative correlation ($r = -0.2541$) in urban areas and a positive correlation ($r = 0.451$) in rural areas. Since motor vehicle fatality is related to access to a vehicle and to speed, it may be that in the larger cities it was difficult to go fast enough for a fatal accident, and in rural areas especially on farms, a farmer who could afford electrification could also afford a car.

Discussion

When Edison and Tesla opened the Pandora's box of electrification in the 1880s, the US vital registration system was primitive at best, and infectious disease death rates were falling rapidly. City residents had higher mortality rates and shorter life expectancy than rural residents [8]. Rural white males in 1900 had an expectation of life at birth of over 10 years longer than urban residents.

Although the authors of the 1950 US vital statistics report noted a 58.2% cancer mortality excess in urban areas, it raised no red flags. The census bureau residential electrification data was obviously not linked to the mortality data. Epidemiologists in that era were still concerned with the communicable diseases.

Count Brown-Sequard (1891) reported [20] the appearance of the childhood leukemia age peak in 1861, forty years after the US vital statistics mortality data on which it was based were available. I reported a cluster of childhood leukemia [21] a decade after it occurred, only because I looked for it. Real time or periodic analysis of national or regional vital statistics data is still only rarely done in the US.

The real surprise in this data set is that cardiovascular disease, diabetes and suicide, as well as cancer, seem to be strongly related to level of residential electrification. A community-based epidemiologic study of urban rural differences in coronary heart disease and its risk factors was carried out in the mid 1990s in New Delhi, India and in a rural area 50 km away [22]. The prevalence of coronary heart disease was three times higher in the urban residents, despite the fact that the rural residents smoked more and had higher total calorie and saturated fat intakes. Most cardiovascular disease risk factors were two to three times more common in the urban residents. Rural electrification projects are still being carried out in parts of the rural area which was studied.

It seems unbelievable that mortality differences of this magnitude could go unexplained for over 70 years after they were first reported and 40 years after they were noticed. I think that in the early part of the 20th century nobody was looking for answers. By the time EMF epidemiology got started in 1979 the entire population was exposed to EMFs. Cohort studies were therefore using EMF-exposed populations statistics to compute expected values, and case control studies were comparing more exposed cases to less exposed controls. The mortality from lung cancer in two pack a day smokers is over 20 times that of non-smokers but only three times that of one pack a day smokers. After 1950, the EMF equivalent of a non-smoker ceased to exist in the US. An exception to this is the Amish who live without electricity. Like rural US residents in the 1940s, Amish males in the 1970s had very low cancer and cardiovascular disease mortality rates [23].

If this hypothesis and findings outlined here are even partially true, the explosive recent increase in radiofrequency radiation, and high frequency voltage transients sources, especially in urban areas from cell phones and towers, terrestrial antennas, wi-fi, and wi-max systems, broadband internet over power lines, and personal electronic equipment, suggests that like the 20th century EMF epidemic, we may already have a 21st century epidemic of morbidity and mortality underway caused by electromagnetic fields. The good news is that many of these diseases may be preventable by environmental manipulation, if society chooses to.

Conflicts of interest statement

None declared.

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A New Electromagnetic Exposure Metric: High Frequency Voltage Transients Associated With Increased Cancer Incidence in Teachers in a California School

Samuel Milham, MD, MPH[1]* and L. Lloyd Morgan, BS[2]

Background *In 2003 the teachers at La Quinta, California middle school complained that they had more cancers than would be expected. A consultant for the school district denied that there was a problem.*

Objectives *To investigate the cancer incidence in the teachers, and its cause.*

Method *We conducted a retrospective study of cancer incidence in the teachers' cohort in relationship to the school's electrical environment.*

Results *Sixteen school teachers in a cohort of 137 teachers hired in 1988 through 2005 were diagnosed with 18 cancers. The observed to expected (O/E) risk ratio for all cancers was 2.78 ($P = 0.00008$), while the O/E risk ratio for malignant melanoma was 9.8 ($P = 0.0095$). Thyroid cancer had a risk ratio of 13.5 ($P = 0.0095$), and prostate cancer had a risk ratio of 9.2 ($P = 0.019$). Sixty Hertz magnetic fields showed no association with cancer incidence. A new exposure metric, high frequency voltage transients, did show a positive correlation to cancer incidence. A cohort cancer incidence analysis of the teacher population showed a positive trend ($P = 7.1 \times 10^{-4}$) of increasing cancer risk with increasing cumulative exposure to high frequency voltage transients on the classroom's electrical wiring measured with a GenSonde/Stetzer (GS) meter. The attributable risk of cancer associated with this exposure was 64%. A single year of employment in this school increased a teacher's cancer risk to 25%.*

Conclusion *The cancer incidence in the teachers at this school is unusually high and is strongly associated with high frequency voltage transients, which may be a universal carcinogen, similar to ionizing radiation.* Am. J. Ind. Med. 2008. © 2008 Wiley-Liss, Inc.

KEY WORDS: high frequency voltage transients; electricity; dirty power; cancer; school teachers; carcinogen

BACKGROUND

Since the 1979 Wertheimer–Leeper study [Wertheimer and Leeper, 1979] there has been concern that exposure to power frequency (50/60 Hz) EMFs, especially magnetic fields, may contribute to adverse health effects including cancer. Until now, the most commonly used exposure metric has been the time-weighted average of the power-frequency magnetic field. However, the low risk ratios in most studies suggest that magnetic fields might be a surrogate for a more important metric. In this paper we present evidence that a

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new exposure metric, high frequency voltage transients existing on electrical power wiring, is an important predictor of cancer incidence in an exposed population.

The new metric, GS units, used in this investigation is measured with a Graham/Stetzer meter (GS meter) also known as a Microsurge II meter (MS II meter), which is plugged into electric outlets [Graham, 2002]. This meter displays the average rate of change of these high frequency voltage transients that exist everywhere on electric power wiring. High frequency voltage transients found on electrical wiring both inside and outside of buildings are caused by an interruption of electrical current flow. The electrical utility industry has referred to these transients as "dirty power."

There are many sources of "dirty power" in today's electrical equipment. Examples of electrical equipment designed to operate with interrupted current flow are light dimmer switches that interrupt the current house per cycle (120 times/s), power saving compact fluorescent lights that interrupt the current at least 20,000 times/s, halogen lamps, electronic transformers and most electronic equipment manufactured since the mid-1980s that use switching power supplies. Dirty power generated by electrical equipment in a building is distributed throughout the building on the electric wiring. Dirty power generated outside the building enters the building on electric wiring and through ground rods and conductive plumbing, while within buildings, it is usually the result of interrupted current generated by electrical appliances and equipment.

Each interruption of current flow results in a voltage spike described by the equation $V = L \cdot di/dt$, where V is the voltage, L is the inductance of the electrical wiring circuit and di/dt is the rate of change of the interrupted current. The voltage spike decays in an oscillatory manner. The oscillation frequency is the resonant frequency of the electrical circuit. The GS meter measures the average magnitude of the rate of change of voltage as a function of time (dV/dT). This preferentially measures the higher frequency transients. The measurements of dV/dT read by the meter are defined as GS (Graham/Stetzer) units.

The bandwidth of the GS meter is in the frequency range of these decaying oscillations. Figure 1 shows a two-channel oscilloscope display. One channel displays the 60 Hz voltage on an electrical outlet while the other channel with a 10 kHz hi-pass filter between the oscilloscope and the electrical outlet, displays the high frequency voltage transients on the same electrical outlet [Havas and Stetzer, 2004, reproduced with permission].

Although no other published studies have measured high frequency voltage transients and risk of cancer, one study of electric utility workers exposed to transients from pulsed

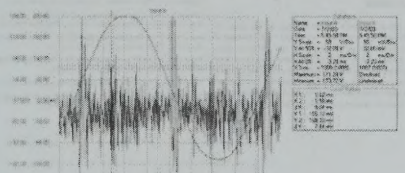
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TABLE IV. Cancer in Teachers Who Ever Taught in Classrooms With at Least One Overload GS Reading (≥2000 GS Units) by Duration of Employment

Ever in a room 2,000 GS units	Employed 10 + years	Total teachers	Cancers observed	Cancers expected	Risk ratio (O/E)	Poisson p
Yes	Yes	10	7*	0.986	7.1*	3.0E-007
Yes	No	30	3*	3.039	0.2	0.056
Total		40	10	4.025	2.5*	0.0003
No	Yes	18	2	1.18	1.7	0.23
No	No	78	4	3.25	1.2	0.365
Total		97	6	4.44	1.4*	0.047
Grand total		137	16	8.49	2.3*	3.0E-006

*Significant and positively correlated.
*P < 0.05.

with a total of seven cancers, and four teachers without a cancer diagnosis, who were employed for 10 or more years and who never worked in one of these rooms. Five teachers had one primary cancer and one teacher had two primary cancers. These teachers made up 7.3% of the teachers' population (10 / 137) but had 7 cancers or 39% (7/18) of the total cancers. The 10 teachers who worked in an overload classroom for 10 years or more had 7 cancers when 0.99 would have been expected ($P = 6.8 \times 10^{-7}$ Poisson test). The risk ratio for the 8 teachers with cancer and 32 teachers without cancer, who ever worked in a room with an overload GS reading, regardless of the time at the school, was 5.1 ($P = 0.0005$, Poisson test). The risk ratio for 8 teachers with cancer and 89 teachers without cancer who never worked in a room with an overload GS reading was 1.8 ($P = 0.047$, Poisson test). Teachers who never worked in an overload classroom also had a statistically significantly increased risk of cancer.

A positive dose-response was seen between the risk of cancer and the cumulative GS exposure (Table V). Three categories of cumulative GS unit-years of exposure were selected: < 5,000, 5,000 to 10,000, and more than 10,000 cumulative GS unit-years. We found elevated risk ratios of 2.0, 5.0, and 4.2, respectively, all statistically significant, for each category. There was a positive trend of increasing cancer incidence with increasing cumulative GS unit-years of exposure ($P = 7.1 \times 10^{-5}$). An exposure of 1,000 GS unit-years increased a teacher's cancer risk by 14%. Working in a room with a GS overload (≥2,000 GS units) for 1 year increased cancer risk by 36%.

An attributable risk percentage was calculated: (observed cancers-expected cancers)/observed cancers = (18 − 8.51)/18 = 63.8%.

The fact that these cancer incidence findings were generated by a single day of GS meter readings made in June 8, 2006 suggests that the readings were fairly constant over time since the school was built in 1990. For example, if the 13 classrooms which overloaded the meter on June 8, 2006 were not the same since the start of the study and constant throughout, the cancer risk of teachers who ever worked in the overload rooms would have been the same as the teachers who never worked in an overload room.

Although teachers with melanoma and cancers of the thyroid, and uterus had very high, statistically significant risk ratios, there was nothing exceptional about their age at hire, duration of employment, or cumulative GS exposure. However, thyroid cancer and melanoma had relatively short latency times compared to the average latency time for all 18 cancers. The average latency time between start of

TABLE V. Observed and Expected Cancers by Cumulative GS Exposure (GS Unit-Years)

Exposure group	5,000 GS unit-years	5,000 to 10,000	10,000 GS unit-years	Total
Average GS unit-years	913	7687	19,483	
Cancer cases	6	4	8	18
Cancer exp	4.507	0.798	1.95	6.23
Risk ratio (O/E)	2.0*	5.0*	4.2*	2.9*
Poisson p	0.0229	0.0026	0.0062	0.0009

Positive trend test (Cochrane with one degree of freedom = 18.8, $P = 7.1 \times 10^{-5}$).
*P < 0.05.

teachers' bodies. The energy that is capacitively coupled to the teachers' bodies is proportional to the frequency. It is this characteristic that highlights the usefulness of the GS meter. High frequency dirty power travels along the electrical distribution system in and between buildings and through the ground. Humans and conducting objects in contact with the ground become part of the circuit. Figure 2 (Havas and Stetzer, 2006, reproduced with permission) shows an oscilloscope tracing taken between EKG patches on the ankles of a man wearing shoes, standing at a kitchen sink. The 60 Hz sine wave is distorted by high frequencies, which allows high frequency currents to oscillate up one leg and down the other between the EKG patches.

Although not demonstrated in this data set, dirty power levels are usually higher in environments with high levels of 60 Hz magnetic fields. Many of the electronic devices which generate magnetic fields also inject dirty power into the utility wiring. Magnetic fields may, therefore, be a surrogate for dirty power exposures. In future studies of the EMF/cancer association, dirty power levels should be studied along with magnetic fields.

The question of cancer incidence in students, who attended La Quinta Middle School for 3 years has not been addressed.

CONCLUSION

The cancer incidence in the teachers at this school is unusually high and is strongly associated with exposure to high frequency voltage transients. In the 28 years since electromagnetic fields (EMFs) were first associated with cancer, a number of exposure metrics have been suggested. If our findings are substantiated, high frequency voltage transients are a new and important exposure metric and a possible universal human carcinogen similar to ionizing radiation.

ACKNOWLEDGMENTS

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employment at the school and diagnosis for all cancers was 9.7 years. The average latency time for thyroid cancer was 3.0 years and for melanoma it was 7.3 years (with three of the four cases diagnosed at 2, 5, and 5 years).

An independent analysis of this data set by the University of Pittsburgh School of Public Health using OCMAP software supported our findings.

DISCUSSION

Because of access denial, we have no information about the source or characteristics of the high frequency voltage transients. We can assume, because the school uses metal conduit to contain the electrical wiring, that any resultant radiated electric fields from these high frequency voltage transients would radiate mainly from the power cords and from electrical equipment using the power cords within a classroom.

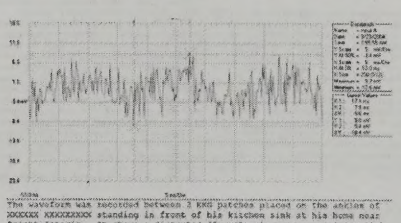
The school's GS readings of high frequency voltage transients are much higher than in other tested places (Table I). Also, teachers in the case school who were employed for over 10 years and who had ever worked in a room with an overload GS reading had a much higher rate of cancer. They made up 7.3% of the cohort but experienced 39% of all cancers.

The relatively short latency time of melanoma and thyroid cancers suggests that these cancers may be more sensitive to the effects of high frequency voltage transients than the other cancers seen in this population.

In occupational cohort studies, it is very unusual to have a number of different cancers with an increased risk. An exception to this is that cohorts exposed to ionizing radiation show an increased incidence of a number of different cancers. The three cancers in this cohort with significantly elevated incidence, malignant melanoma, thyroid cancer and uterine cancer, also have significantly elevated incidence in the large California school employees cohort [Reynolds et al., 1999].

These cancer risk estimates are probably low because 23 of the 137 members of the cohort remain unfazed. Since exposure was calculated based on 7 days a week for a year, this will overstate the actual teachers' exposure of 5 days a week for 9 months a year.

We could not study field exposures in the classrooms since we were denied access to the school. We postulate that the dirty power in the classroom wiring caused its effect by capacitive coupling which induced electrical currents in the



The waveform was recorded between 2 EKG patches placed on the ankles of XXXXXX XXXXXXXXX standing in front of his kitchen sink at his home near Bright Oakville. It shows a distorted 60 cycle sine wave containing high frequencies applied to each foot, allowing high frequency current to freely oscillate up one leg and down the other. XXXXXX has been diagnosed with prostrate cancer since moving to the house in less than a year. He was standing with feet shoulder width apart, wearing shoes, at the time of the readings. The amplitude increased as the feet were placed farther apart.

FIGURE 2. Oscilloscope display of 60-cycle electrical line with high frequencies taken between EKG patches applied to the ankles of a person standing with shoes on at a kitchen sink. (Color figure is for viewed in the online issue, which is available at www.interscience.wiley.com.)

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Could Microwaves Be Associated With Children's Asthma?

By ALICE PARK Tuesday, August 2, 2011

PRINT

Exposure to electromagnetic fields has been linked to a number of health problems, including cancer and immune system and reproductive abnormalities, and now the latest research adds another concern to the list: childhood asthma.

In the first study of its kind, scientists strapped magnetic field monitors on pregnant women to determine their level of exposure, and studied whether it was associated with the risk of asthma in their children. They found that children born to women with the highest levels of exposure to electromagnetic fields (EMF) — including from microwaves, hair dryers and power lines — had a more than three-fold higher rate of asthma compared to those whose moms had the lowest exposure.

The monitors specifically measured low-frequency magnetic fields, which often co-exist with electromagnetic energy, says lead author Dr. De-Kun Li, a reproductive and perinatal epidemiologist at Kaiser Permanente Division of Research.

They study builds on previous work Li and his group have done looking at the effect of EMF exposure on miscarriage. In that investigation, Li found that women with high levels of exposure had double the risk of miscarrying than women with lower levels of EMF exposure.

Li's team then followed-up with the women who delivered and recorded the number of cases of asthma among their children 13 years later. The researchers focused on asthma because the recent, rapid increase in cases of the disorder suggests that an environmental trigger may be at play: there are genetic components to the immune system disorder as well, but genes simply don't change that fast in populations.

Li's team looked at the link between asthma and EMF levels because people are much more likely to be exposed to these fields now than ever before. "EMF is really increasing partially because electricity use is increasing, through electronic devices and wireless networks," he says.

Li asked the women wearing the monitors to record where they spent their days. Their time could be divided into one of five place categories: home but not in bed, home and in bed, at work, traveling, or everywhere else. The women were not able to see their level of magnetic field exposure, so as not to bias their behavior.

Li found that exposure levels were about the same in all locations, but he attributes the most exposure to EMF to the use of common household appliances such as the microwave oven, vacuum cleaner and hair dryer. Pretty much anything that uses electricity, he says, including refrigerators, stoves, automobiles and power lines, generates low-frequency EMF.

What the devices were not designed to measure, however, was exposure to higher-frequency magnetic fields such as those emitted by cell phones and wireless networks, which are ubiquitous in homes and offices. These may be nearly impossible to avoid, but Li suggests that pregnant women can at least reduce some of their exposure to the low-frequency fields. Don't stand in front of the microwave when it's heating food, for example, and hold the hair dryer as far away from your body as possible, or switch to a dryer that's battery operated.

"Pregnancy is the most sensitive time for the fetus," Li says. "Animal studies show that EMF can impact the immune system, and the latest research suggests that cells use magnetic fields to communicate with each other. If an external EMF comes into interfere with that, cell communication needed for normal development can be disrupted."

Alice Park is a writer at TIME. Find her on Twitter at @aliceparking. You can also continue the discussion on TIME's Facebook page and on Twitter at @TIME.

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http://healthland.time.com/2011/08/02/microwaves-and-asthma-exposure-to-magnetic-fields-during-pregnancy-ups-asthma-risk-among-newborns/

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2.2.3. Sleep disturbance and impairment of the ability to return to sleep is not trivial as almost all of us can testify. In the short term, the resulting deprivation of sleep results in daytime fatigue and sleepiness, poor concentration and memory function. Accident risks increase. In the longer term, sleep deprivation is linked to depression, weight gain, diabetes, high blood pressure and heart disease. ···

3.8.2. In weighing the evidence, I find that, on the one hand there is a large number of reported cases of sleep disturbance and, in some cases, ill health, as a result of exposure to noise from wind turbines supported by a number of research reports that tend to confirm the validity of the anecdotal reports and provide a reasonable basis for the complaints. On the other, we have badly designed industry and government reports which seek to show that there is no problem. I find the latter unconvincing.

3.8.3. In my expert opinion, from my knowledge of sleep physiology and a review of the available research, I have no doubt that wind turbine noise emissions cause sleep disturbance and ill health. ···

4.4.1. Table 1 (see end of text) shows recommendations for setback distance by a number of authorities. References can be found in the Bibliography. In general, noise engineers recommend lesser setback distances than physicians. The former rely more on measured and/or calculated sound pressures and the latter on clinical reports. It is logical to prefer the actual reports of the humans subjected to the noise rather than abstract calculations, even if the latter accurately measure ambient noise and allow for the low frequency components of wind turbine noise. Calculations can not measure annoyance and sleep disturbance, only humans can do so.

4.4.2. A setback distance of at least 1.5km is necessary to ensure, with a reasonable degree of confidence, that the wind turbine noise will not disturb the sleep of those living in proximity to the proposed Swinford development.

Download original document: "Sleep disturbance and wind turbine noise" [2]

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July 2, 2009
Health, Noise, Regulations

Sleep disturbance and wind turbine noise

Hanning, Christopher

Report by Dr Christopher Hanning, BSc, MB, BS, MRCS, LRCP, FRCA, MD, on behalf of Stop Swinford Wind Farm Action Group (SSWFAG [1]) — June 2009

2.2.4. Noise interferes with sleep in several ways. Firstly, it may be sufficiently loud or annoying to prevent the onset of sleep or the return to sleep following an awakening. It is clear also that some types of noise are more annoying than others. Constant noise is less annoying than irregular noise which varies in frequency and loudness, for example, snoring, particularly if accompanied by the snorts of sleep apnoea (breath holding). The swishing or thumping noise associated with wind turbines seems to be particularly annoying as the frequency and loudness varies with changes in wind speed and local atmospheric conditions. While there is no doubt of the occurrence of these noises and their audibility over long distances, up to 5–4km in some reports, the actual cause has not yet been fully elucidated (Bowdler 2008). Despite recommendations by the Government's own Noise Working Group, UK research in this area has been stopped.

2.2.5. Secondly, noise experienced during sleep may arouse or awaken the sleeper. A sufficiently loud or prolonged noise will result in full awakening which may be long enough to recall. Short awakenings are not recalled as, during the transition from sleep to wakefulness, one of the last functions to recover is memory (strictly, the transfer of information from short term to long term memory). The reverse is true for the transition from wakefulness to sleep. Thus only awakenings of longer than 20–30 seconds are subsequently recalled. Research that relies on recalled awakenings alone may underestimate the effect.

2.2.6. Noise insufficient to cause awakening may cause an arousal. An arousal is brief, often only a few seconds long, with the sleeper moving from a deep level of sleep to a lighter level and back to a deeper level. Because full wakefulness is not reached, the sleeper has no memory of the event but the sleep has been disrupted just as effectively as if wakefulness had occurred. It is possible for several hundred arousals to occur each night without the sufferer being able to recall any of them. The sleep, because it is broken, is unrefreshing resulting in sleepiness, fatigue, headaches and poor memory and concentration (Martin 1997), many of the symptoms of "wind turbine syndrome". Arousals are associated not just with an increase in brain activity but also with physiological changes, an increase in heart rate and blood pressure, which are thought to be responsible for the increase in cardiovascular risk. Arousals occur naturally during sleep and increase with age (Boselli 1998) which may make the elderly more vulnerable to wind turbine noise. Arousals may be caused by sound events as low as 32 dBA and awakenings with events of 42dBA (Muzet and Miedema 2005), well within the measured noise levels of current "wind farms" and the levels permitted by ETSU-R-97 . Arousals in SWS may trigger a parasomnia (sleep walking, night terrors etc.). Pierpont (2009) and personal communication) notes that parasomnias developed in some of the children in her study group when exposed to turbine noise. ···

Report by

Dr Christopher HANNING

BSc, MB, BS, MRCS, LRCP, FRCA, MD

on

Sleep disturbance and wind turbine noise

on behalf of

Stop Swinford Wind Farm Action Group (SSWFAG)

June 2009

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1. Introduction

1.1 The author

1.1.1. My name is Dr Christopher Hanning. Honorary Consultant in Sleep Disorders Medicine to the University Hospitals of Leicester NHS Trust, based at Leicester General Hospital, having retired in September 2007 as Consultant in Sleep Disorders Medicine. In 1968, I obtained a First class Honours BSc in Physiology and, in 1972, qualified in medicine, MB, BS, MRCP, LRCP from St Bartholomew's Hospital Medical School. After initial training in anaesthesia, I became a Fellow of the Royal College of Anaesthetists by examination in 1976 and was awarded a doctorate from the University of Leicester in 1996. I was appointed Senior Lecturer in Anaesthesia and Honorary Consultant Anaesthetist to Leicester General Hospital in 1981. In 1998, I was appointed Consultant Anaesthetist with a special interest in Sleep Medicine to Leicester General Hospital and Honorary Senior Lecturer to the University of Leicester.

1.1.2. My interest in sleep and its disorders began nearly 30 years ago and has grown ever since. I founded and ran the Leicester Sleep Disorders Service, one of the longest standing and largest services in the country, until retirement. The University Hospitals of Leicester NHS Trust named the Sleep Laboratory after me as a mark of its esteem. I was a founder member and President of the British Sleep Society and its honorary secretary for four years and have written and lectured extensively on sleep and its disorders and continue an active research programme. My expertise in this field has been accepted by the civil, criminal and family courts. I chair the Advisory panel of the SOMNIA study, a major project investigating sleep quality in the elderly, and sit on Advisory panels for several companies with interests in sleep medicine.

1.1.3. I live in Ashby Magna, Leicestershire which is subject to an application by Broadview Energy for a wind farm at Lower Spinney.

1.2. Brief from SSWFAG

1.2.1. My brief from SSWFAG was to review the potential consequences of wind turbine noise and, in particular, its effect on sleep and health and to make recommendations with regard to the proposed setback distances.

1.3. Scope of report.

1.3.1. This report centres on the effects of industrial wind turbine noise on sleep as this is the particular area of expertise of the author. Other areas of health concern related to low frequency noise emissions and vibro-acoustic disease will be left to others.

1.4. Source material

1.4.1. A full list of the publications reviewed and other source material is given in Section 7 and are cited in the text.

2. Background

2.1. Introduction

2.1.1. There can be no doubt that groups of industrial wind turbines ("wind farms") generate sufficient noise to disturb the sleep and impair the health of those living nearby. Section 5.1.1 of the draft New Zealand standard on wind farm noise, 2009, states: "Limits for wind farm noise are required to provide protection against sleep disturbance and maintain reasonable residential amenity." Reports from many different locations and different countries have a common set of symptoms and have been documented by Frey and Hadden (2007). New cases are documented regularly on the Internet. The symptoms include sleep disturbance, fatigue, headaches, dizziness, nausea, changes in mood and inability to concentrate and have been named "wind turbine syndrome" by Dr Nina Pierpont (2006), one of the

principal researchers in this field. The experiences of the Davis (2008) and Rashleigh (2008) families from Lincolnshire whose homes were around 900m from wind turbines make salutary reading. The noise, sleep disturbance and ill health eventually drove them from their homes. Similar stories have been reported from around the world, in anecdotal form but in large numbers.

2.2. Sleep, sleep physiology and the effects of noise

2.2.1. Sleep is a universal phenomenon. Every living organism contains, within its DNA, genes for a body clock which regulates an activity-inactivity cycle. In mammals, including humans, this is expressed as one or more sleep periods per 24 hours. Sleep was previously thought to be a period of withdrawal from the world designed to allow the body to recuperate and repair itself. However, modern research has shown that sleep is primarily by the brain and for the brain. The major purpose of sleep seems to be the proper laying down and storage of memories, hence the need for adequate sleep in children to facilitate learning and the poor memory and cognitive function in adults with impaired sleep from whatever cause.

2.2.2. Inadequate sleep has been associated not just with fatigue, sleepiness and cognitive impairment but also with an increased risk of obesity, impaired glucose tolerance (risk of diabetes), high blood pressure, heart disease, cancer and depression. Sleepy people have an increased risk of road traffic accidents.

2.2.3 Humans have two types of sleep, slow wave (SWS) and rapid eye movement (REM). SWS is the deep sleep which occurs early in the night while REM or dreaming sleep occurs mostly in the second half of the night. Sleep is arranged in a succession of cycles, each lasting about 90 minutes. We commonly wake between cycles, particularly between the second and third, third and fourth and fourth and fifth cycles. Awakenings are not remembered if they are less than 30 seconds in duration. As we age, awakenings become more likely and longer so we start to remember them.

2.2.4. Noise interferes with sleep in several ways. Firstly, it may be sufficiently loud or annoying to prevent the onset of sleep or the return to sleep following an awakening. It is clear also that some types of noise are more annoying than others. Constant noise is less annoying than irregular noise which varies in frequency and loudness, for example, snoring, particularly if accompanied by the snorts of sleep apnoea (breath holding). The swishing or thumping noise associated with wind turbines seems to be particularly annoying as the frequency and loudness varies with changes in wind speed and local atmospheric conditions. While there is no doubt of the occurrence of these noises and their audibility over long distances, up to 3-4km in some reports, the actual cause has not yet been fully elucidated (Bowdler 2008). Despite recommendations by the Government's own Noise Working Group, UK research in this area has been stopped.

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2.2.6. Noise insufficient to cause awakening may cause an arousal. An arousal is brief, often only a few seconds long, with the sleeper moving from a deep level of sleep to a lighter level and back to a deeper level. Because full wakefulness is not reached, the sleeper has no memory of the event but the sleep has been disrupted just as effectively as if wakefulness had occurred. It is possible for several hundred arousals to occur each night without the sufferer being able to recall any of them. The sleep, because it is broken, is unrefreshing resulting in sleepiness, fatigue, headaches and poor memory and concentration (Martin 1997), many of the symptoms of "wind turbine syndrome". Arousals are associated not just with an increase in brain activity

but also with physiological changes, an increase in heart rate and blood pressure, which are thought to be responsible for the increase in cardiovascular risk. Arousals occur naturally during sleep and increase with age (Boselli 1998) which may make the elderly more vulnerable to wind turbine noise. Arousals may be caused by sound events as low as 32 dBA and awakenings with events of 42dBA (Muzet and Miedema 2005), well within the measured noise levels of current "wind farms" and the levels permitted by ETSU-R-97 . Arousals in SWS may trigger a parasomnia (sleep walking, night terrors etc.). Pierpont (2009 and personal communication) notes that parasomnias developed in some of the children in her study group when exposed to turbine noise.

2.2.7. Arousals are caused by aircraft, railway and traffic noise. In one study of aircraft noise, arousals were four times more likely to result than awakenings (Basner 2008a&b). Freight trains are more likely to cause arousals than passenger trains, presumably because they are slower, generating more low frequency noise and taking longer to pass (Saremi 2008). The noise of wind turbines has been likened to a "passing train that never passes" which may explain why wind turbine noise is prone to cause sleep disruption.

2.2.8. It is often claimed that continual exposure to a noise results in habituation, i.e. one gets used to the noise. There is little research to confirm this assertion and a recent small study (Pirrera et al. 2009) looking at the effects of traffic noise on sleep efficiency suggests that it is not so.

2.2.9. Sleep disturbance and impairment of the ability to return to sleep is not trivial as almost all of us can testify. In the short term, the resulting deprivation of sleep results in daytime fatigue and sleepiness, poor concentration and memory function. Accident risks increase. In the longer term, sleep deprivation is linked to depression, weight gain, diabetes, high blood pressure and heart disease. There is a very large body of literature but please see Meerlo et al., 2008, Harding and Feldman, 2008 and Hart et al., 2008 for recent work on this subject. A more general review can found on Wikipedia: http://en.wikipedia.org/wiki/Sleep_deprivation

3. Wind turbine noise, sleep and health

3.1. Introduction

3.1.1. The evidence above demonstrates that it is entirely plausible that wind turbine noise has the potential to cause arousals, sleep fragmentation and sleep deprivation. As noted above, the draft New Zealand standard on wind farm noise (2009) acknowledges that sleep disturbance is the major consequence of wind turbine noise.

3.1.2 Unfortunately **all** government and industry sponsored research in this area has used **reported awakenings** from sleep as an index of the effects of turbine noise and dismisses the subjective symptoms. Because most of the sleep disturbance is not recalled, this approach seriously **underestimates** the effects of wind turbine noise on sleep.

3.2. Early research.

3.2.1. Surveys of residents living in the vicinity of industrial wind turbines show high levels of disturbance to sleep and annoyance. A 2005 survey of 200 residents living within 1km of a 6 turbine, 9MW installation in France showed that 27% found the noise disturbing at night (Butre 2005). A similar US survey in 2001 (Kabes 2001) of a "wind farm" in Kewaunee County, Wisconsin reported that 52% of those living within 400-800 metres found the noise to be a problem, 32% of those living within 800-1600 metres and 4% of those within 1600 and 3200 metres. 67% of those living within 250 to 400 metres and 35% of those within 400-800 metres reported being awoken by the sound in the previous year. The principal health problem reported by the 223 respondents was sleep loss. The landscape of Kewaunee County is described as "undulating to gently rolling", not dissimilar to South Leicestershire. All of these studies were of smaller turbines than proposed by Nuon. Pedersen and Waye (2004) reported that "16% (n=20, 95%CI: 11%–20%) of the 128 respondents living at sound exposure above 35.0 dBA stated that they were disturbed in their sleep by wind turbine noise."

3.2.2. Phipps and others (2007) surveyed 1100 New Zealand residents living up to 3.5 km from a wind farm, 604 responded. 75% of all respondents reported being able to hear the noise. Two separate developments have placed over 100 turbines with capacities from 600kW to 1.65MW in this hilly to mountainous area. It has been suggested that mountainous areas may allow low frequency noise to travel further which may explain the long distance over which the turbines were heard. Van den Berg (2004) found that residents up to 1900 m from a wind farm expressed annoyance with the noise, a finding replicated in his more recent study reported below. Dr Amanda Harry (2007), a UK GP, conducted surveys of a number of residents living near several different turbine sites and reported a similar constellation of symptoms from all sites. A study of 42 respondents showed that 81% felt their health had been affected, in 76% it was sufficiently severe to consult a doctor and 73% felt their life quality had been adversely impacted. This study is open to criticism for its design which invited symptom reporting and was not controlled. While the proportion of those affected may be questioned it nevertheless indicates strongly that some subjects are severely affected by wind turbine noise at distances thought by the industry to be safe.

3.3. Project WINDFARMperception

3.3.1. van den Berg and colleagues (2008) from the University of Groningen in the Netherlands have recently published a major questionnaire study of residents living within 2.5km from wind turbines. Project WINDFARMperception. A random selection of 725 residents were sent a similar questionnaire to that used by Pedersen in her studies in Sweden (2003, 2004, 2007 and 2008), questions on health, based on the validated General Health Questionnaire (GHQ), were added. 37% replied which is good for a survey of this type but, nevertheless is a weakness. Questions on wind turbine noise were interspersed with questions on other environmental factors to avoid bias. The sound level at the residents' dwellings was calculated, knowing the turbine type and distance and the calculated

ambient noise, derived from an environmental sound map of the Netherlands, according to the international ISO standard for sound propagation, the almost identical Dutch legal model and a simple (non spectral) calculation model. The indicative sound level used was the sound level when the wind turbines operate at 8 m/s in daytime - that is: at high, but not maximum power. Noise exposure ranged between 24 and 54dBA. It is worth noting that the industry was approached for assistance in the research but refused. Complaints such as annoyance, waking from sleep, difficulty in returning to sleep and other health complaints were related to the calculated noise levels. Relevant conclusions include. *"Sound was the most annoying aspect of wind turbines"* and was more of an annoyance at night. Interrupted sleep and difficulty in returning to sleep increased with calculated noise level as did annoyance, both indoors and outdoors. Even at the lowest noise levels, 20% of respondents reported disturbed sleep at least one night per month. At a calculated noise level of 30-35dBA, 10% were rather or very annoyed at wind turbine sound, 20% at 35-40dBA and 25% at 40-43dBA (the permitted ETSU-R-97 night time level).

3.3.2. Project WINDFARMperception further found that *"Three out of four participants declare that swishing or lashing is a correct description of the sound from wind turbines. Perhaps the character of the sound is the cause of the relatively high degree of annoyance. Another possible cause is that the sound of modern wind turbines on average does not decrease at night, but rather becomes louder, whereas most other sources are less noisy at night. At the highest sound levels in this study (45 decibel or higher) there is also a higher prevalence of sleep disturbance."* The lack of a control group prevents this group from making firmer conclusions about turbine noise and sleep disturbance but it is clear that as ETSU-R-97 permits an exterior night time noise level of 43dB, relying on its calculations will guarantee disturbed sleep for those living nearby.

3.3.3. van den Berg concluded also that, contrary to industry belief, road noise does not adequately mask turbine noise and reduce annoyance and disturbance. In addition, they compared their results with studies by

Miedema on the annoyance from road, rail and air related noise. Wind turbine noise was several times more annoying than the other noise sources for equivalent noise levels (**Fig 1**). Similar data is given by Pedersen (2004) (**Fig 2**) – **see end of text** .

3.3.4 With regard to health it was concluded that: *"There is no indication that the sound from wind turbines had an effect on respondents' health, except for the interruption of sleep. At high levels of wind turbine sound (more than 45 dBA) interruption of sleep was more likely than at low levels. Higher levels of background sound from road traffic also increased the odds for interrupted sleep. Annoyance from wind turbine sound was related to difficulties with falling asleep and to higher stress scores. From this study it cannot be concluded whether these health effects are caused by annoyance or vice versa or whether both are related to another factor."* The conclusions regarding health are not justified from the data for the reasons given below and must be disregarded.

3.3.5. Project WINDFARMperception is currently the largest study in this field but the study is not without considerable flaws. The study may be criticised for using calculated noise levels and for not having a control group (residents not living near turbines). While several of the contributors have expertise in the investigation of health matters none has specific expertise in the physiology and pathophysiology of sleep. The purpose of the study, as its title suggested, was the public perception of wind turbines and their noise. Health questions were added but were of a very general nature. The small number of respondents suggests that any conclusions as to the apparent lack of an effect on health must be regarded as tentative.

3.3.6. The analysis of reported sleep interruption and wind turbine sound levels is flawed by the use of subjects exposed to calculated external sound levels of <30dBA (p53) as the "controls". It has been noted by several studies that calculated turbine noise is often less than measured noise and that levels as low as 30dBA can cause annoyance (Pedersen 2007). Examination of the odds ratio for different calculated sound levels (Table 7.42) shows that it

increases progressively with increasing sound levels starting at 30-35dBA and becomes statistically significant for levels >45dBA. If, as is not impossible, the "control" group had its sleep disturbed by wind turbine noise then the actual effect would be considerably underestimated.

3.3.7. The major objection to the conclusions on health is that the study is grossly under-powered (insufficient subjects were studied for any degree of statistical confidence). Wind turbine syndrome, to the degree reported by Pierpont (2009), does not seem to be common even amongst those exposed to high noise levels. The study was designed to detect chronic disease with the GHQ, which is a fairly crude instrument. Assuming that wind turbine syndrome affects 1% of those exposed to calculated sound levels >45dBA and that 25% of the general population suffer from chronic disease (p47) then at least 30,000 subjects would need to be studied in each group (<45dBA v >30dBA) to be able to prove a difference with 95% certainty. Even if a prevalence of wind turbine syndrome of 5% of those exposed to >45dBA is assumed, then there must be at least 1250 subjects in each group. This study therefore can not conclude that wind turbines do not cause ill health of any degree, it can not even make conclusions about severe ill health.

3.4. Pierpont studies

3.4.1. Pierpont (2009 and personal communication) has recently completed a very detailed, peer-reviewed case-control study of 10 families around the world who have been so affected by wind turbine noise that they have had to leave their homes, nine of them permanently. The turbines ranged from 1.5 to 3MW capacity at distances between 305 to 1500m. The group comprised 21 adults, 7 teenagers and 10 children of whom 23 were interviewed. While this is a highly selected group, the ability to examine symptoms before, during and after exposure to turbine noise gives it a strength rarely found in similar case-control studies. The subjects described the symptoms of wind turbine syndrome outlined above and confirmed that they were not present before the turbines started operation and resolved once exposure ceased.

There was a clear relationship between the symptoms, even in children, and the noise exposure. She reports also that all adult subjects reported *"feeling jittery inside"* or *"internal quivering"*, often accompanied by anxiety, fearfulness, sleep disturbance and irritability. Pierpont offers compelling evidence that these symptoms are related to low frequency sound and suggests very plausible physiological mechanisms to explain the link between turbine exposure and the symptoms.

3.4.2. Of particular concern were the observed effects on children, include toddlers and school and college aged children. Changes in sleep pattern, behaviour and academic performance were noted. 7 of 10 children had a decline in their school performance while exposed to wind turbine noise which recovered after exposure ceased. In total, 20 of 34 study subjects reported problems with concentration or memory.

3.4.3. Pierpont's study mostly addresses the mechanism for the health problems associated with exposure to wind turbine noise rather than the likelihood of an individual developing symptoms. Nevertheless, it convincingly shows that **wind turbine noise does cause the symptoms of wind turbine syndrome**, including sleep disturbance. She concludes by calling for further research, particularly in children, and a 2km setback distance.

3.4.4. A recent paper (Todd et al, 2008) has shown that the vestibular system in the human ear, the part concerned with detection of movement and balance, is exquisitely sensitive to vibration at frequencies of around 100Hz. While this must be regarded as preliminary data, it does offer further evidence in support of Dr Pierpont's findings and theories.

3.5. DTI report

3.5.1. Nuon is likely to refer to a DTI report by the Hayes McKenzie Partnership published in 2006 which investigated low frequency noise at three UK wind farms. Hayes McKenzie have a long term relationship with the wind turbine industry, are noise engineers with no medical or physiological expertise so their suitability to undertake the work must be questioned. They took sound measurements at three of five sites where complaints had been recorded over periods from 1-2 months. Communication with residents other than those who complained was minimal. However, they did confirm that *"some wind farms clearly result in modulation at night which is greater than that assumed with the ETSU-R-97 guidelines"*. Measured *"internal noise levels were insufficient to wake up residents at these three sites. However, once awoken, this noise can result in difficulties in returning to sleep."* The lack of physiological expertise in the investigators in not recognising that noise can disturb sleep without actual recalled awakening is a major methodological flaw rendering the conclusions unreliable, as is the short recording period. It is well recognised also that not every resident affected by a nuisance such as noise will actually register a complaint. Many will not be sufficiently literate or confident so to do and others may wish to avoid drawing attention to the problem to protect property prices. They may assume also that protest is futile, which seems to be the experience of many with wind turbine noise. Recorded complaints are thus the tip of the iceberg.

3.5.2. It will be claimed also that only 5 of 126 wind energy developments at the time of the study had attracted complaints of noise and thus the matter is trivial. This assertion is, to say the least, disingenuous. Many of the developments at that time were of small turbines set in isolated areas of the countryside, well away from habitation. In addition, as noted above, the proportion of those affected by wind turbine noise who actually complain is very small. It must be emphasised that research into wind farm noise and health issues in the UK is virtually non-existent and of poor quality. To suggest that there is "no problem" when faced with the large body of evidence presented here is perverse. The conclusion is also contradicted by Moorhouse's study (vide infra) which showed a complaint rate of 20%.

3.6. Salford study

3.6.1. Nuon is likely to refer also to a report by Moorhouse and others of the University of Salford, commissioned by DEFRA into Aerodynamic Modulation of Wind Turbine Noise published in 2007. A survey was made of the local authorities responsible for wind farms in, or adjacent to, their area. 133 wind farms were identified of which 27 (20%) had attracted complaints. An attempt was made to correlate complaint logs with recorded wind speed and direction. Once again the methodology is fundamentally flawed. Complaints were solicited from local authorities and not from residents. The review was entirely theoretical with no communication with residents. The conclusions were that AM was such a minor problem that no further research was warranted.

3.6.2. The Editor of Noise Bulletin greeted the publication of the report thus:

> *"'New report eases concerns over wind turbine noise' trumpets the Government press release, then saying aerodynamic modulation is 'not an issue for the UK's wind farm fleet'. This conclusion is not justified based on the report, and by halting further research work without transparently monitoring the wind farms subject to complaints will inflame, not ease concern of objectors ... Only when the public can trust the Government and wind farm developers on noise issues will there be a chance that the public will accept them without a fight ..."*
> (Pease J. *Noise Bulletin*, Issue 15, Aug/Sept. 2007 page 5).

3.6.3. On 2 August 2007, Dick Bowdler, an acoustician and member of the Noise Working Group which commissioned the report, resigned from the NWG. This highly unusual step was taken because, as his letter states:

> *"I have read the Salford Report and the Government Statement. As a result I feel obliged to resign from the Noise Working Group.*
> *The Salford Report says that the aims of this study are to ascertain the prevalence of AM from UK wind farm sites, to try to gain a better understanding of the likely cause, and to establish whether further research into AM is required. This bears little relation to what we asked for which clearly set out in the minutes of the meeting in August 2006. We all knew then (as was recorded in the original notes of the meeting) that complaints concerning wind farm noise are currently the exception rather than the rule. The whole reason for needing the research was that 'The trend for larger more sophisticated turbines could lead to an increase in noise from AM'.*

> *It was not the intended purpose of the study to establish whether more research was required. We all agreed at the August 2006 meeting that such research was needed. That was precisely the outcome of the meeting. The prime purpose of what eventually became the Salford Report was to identify up to 10 potential sites which could be used to carry out objective noise measurements. The brief for the Salford report, which was never circulated to the NWG, completely ignored the NWG views.*
> *Additionally, I find it entirely unacceptable that we are not to be told the names of the wind farms listed in the Salford report. So the only part of the report of any value to assist future research is inaccessible to those of us who would like to progress matters further.*
> *Looking at the Government Statement it is clear that the views of the NWG (that research is needed into AM to assist the sustainable design of wind farms in the future) have never been transmitted to government and so the Statement is based on misleading information".*
> (*Noise Bulletin*, Issue 15, Aug/Sept. 2007 page 5)

3.6.4. If both a leading commentator in the field and a leading member of the Government's own working group have no faith in the study then its conclusions may safely be dismissed.

3.7. Kamperman comments

3.7.1. George Kamperman, (2008 personal communication) a distinguished US noise engineer, is quoted in Pierpont's book as saying, *"After the first day of digging into the wind turbine noise impact problems in different countries, it became clear the health impact on persons living within about two miles from 'wind farms' all had similar complaints and health problems. I have never seen this type of phenomenon [in] over fifty plus years of consulting on industrial noise problems. The magnitude of the impact is far above anything I have seen before at such relatively low sound levels. I can see the devastating health impact from wind turbine noise but I can only comment on the physical noise exposure. From my viewpoint we desperately need noise exposure level criteria."* Kamperman's recommended setback of at least 1km (Kamperman & James 2008) has changed to at least 2km as a result of Dr Pierpont's evidence (Kamperman 2008 personal communication). He has recently published a more detailed set of recommendations to determine setback distances (Kamperman & James 2008b).

3.8. Conclusions

3.8.1. The quality of the research in this area is low. Most are surveys using self-completed questionnaires. Response rates have generally been quite good for this type of enquiry, which may reflect the public interest and concern that wind turbines generate. Nevertheless, it is inevitable that it is more likely that those who feel they have been affected will respond rather than those who have not. The questionnaires themselves have not always have been well drafted. Most do not have a control group, a separate group not exposed to turbine noise with whom to make comparisons. The studies are all post hoc, initiated after the turbines have been operating and generally in response to complaints. The lack of pre-exposure data weakens the studies but does not invalidate them totally. Many of the authors have been criticised for their presumed lack of expertise in this area. The poor quality of the research is not surprising as government and industry have refused funding and co-operation and individuals conducting research have had to rely on their own resources.

3.8.2. In weighing the evidence, I find that, on the one hand there is a large number of reported cases of sleep disturbance and, in some cases, ill health, as a result of exposure to noise from wind turbines supported by a number of research reports that tend to confirm the validity of the anecdotal reports and provide a reasonable basis for the complaints. On the other, we have badly designed industry and government reports which seek to show that there is no problem. I find the latter unconvincing.

3.8.3. **In my expert opinion, from my knowledge of sleep physiology and a review of the available research, I have no doubt that wind turbine noise emissions cause sleep disturbance and ill health.**

4. Preventing sleep disturbance from wind turbine noise.

4.1 Background

4.1.1. Developers of noisy industrial processes, including wind turbines, seek to mitigate the disturbance by siting them in areas of high ambient noise, such as close to major roads. In the case of wind turbines, it is assumed that rising wind speed will not only increase turbine noise but ambient noise also. This is, of course, not the case if you are sheltered from the wind in your bedroom. Motorway noise diminishes at night as the volume of traffic decreases. In addition, it is common for wind speeds to diminish at ground level as night falls while being maintained at turbine hub level, wind shear (Pedersen E and Persson Waye K. 2003, Schneider 2007). In both cases, the turbine noise will be much more audible as ambient noise decreases and explains why complaints of nocturnal noise and disturbed sleep are common. The importance of wind shear has been acknowledged in a recent technical contribution to Acoustics Bulletin (March April 2009) from some members of the NWG calling for all noise levels to be referenced to wind speed at turbine hub height.

4.1.2. Schneider found that night time turbine noise was between 3 and 7dBA greater than predicted and, during periods of atmospheric stability, turbine noise was 18.9 to 22.6dBA above ambient. In addition, as noted above, the characteristics of wind turbine noise are such that it can be heard despite road noise. It should be noted that as the decibel scale is logarithmic, a 6dB increase is equivalent to a **doubling** in sound pressure level and a 12dB change is a **quadrupling.**

4.1.3. van den Berg, in a paper presented at Euronoise 2003, investigated the relationship between calculated noise generated by wind turbines and that actually measured. He confirmed that the turbines were more audible at night principally due to amplitude modulation. To quote his paper, *"As measured immission levels near the wind park Rhede show, the discrepancy may be very large: sound levels are up to 15 dB (!) higher than expected at 400 m from the wind park. At a distance of 1500 m actual sound levels are 18 dB higher than expected, 15 dB of this because of the higher sound emission and 3 dB because sound attenuation is less than predicted by the sound propagation model."* An 18dB increase is equivalent to an **8 fold increase** in sound pressure and a 15dB change is a **6 fold increase**. An 18dB increase is a close to a three fold increase in perceived loudness. **Calculated measures of wind turbine noise are woefully inadequate.**

4.2. Mitigation of wind turbine noise

4.2.1. Bowdler (2008) has recently reviewed the causation of the swishing and thumping noises associated with wind turbines. He concludes that, while there are several theories, no definitive mechanism can be established. It follows that industry claims to mitigate turbine noise by changing blade shape and turbine spacing should be treated with scepticism until definitive evidence of their efficacy are presented.

4.2.2. It follows that attempts to reduce wind turbine noise immissions after plant becomes operational are unlikely to be successful. Blade feathering will reduce power output, which will be opposed by the operators. The importance of assuring residents that noise limits are capable of being met before construction was emphasised by Mr Lavender, Inspector at the Thackson's Well Inquiry (APP/E2530/A/08/2073384) who stated: "securing compliance with noise limit controls at wind farms, in the event of a breach, is not as straightforward as with most other forms of noise generating development. This is because noise from turbines is affected primarily by external factors such as topography and wind strength, a characteristic that distinguishes them from many other sources of noise, such as internal combustion engines or amplified music, which can be more directly and immediately influenced by silencing equipment, insulation or operator control." It follows that application of the precautionary principle is essential where there is any possibility of noise disturbance from wind turbines.

4.2.3. Thus, the **only** mitigation for wind turbine noise is to place a sufficient distance between the turbines and places of human habitation. PPS22 advises that ETSU-R-97 *should* (author's italics) be used to estimate noise levels around turbines which taken with measurements of ambient noise can, in theory, predict noise disturbance in adjacent properties. Many expert acousticians have severely criticised ETSU-R-97, not least Mr Dick Bowdler (2007), a member of the Government's Noise Working Group considering ETSU-R-97. Its major flaws include the use of **averaged** noise levels over too long a time period and using a best fit curve, thus ignoring the louder transient noise of AM which cause awakenings and arousals. It ignores also the property of low frequency noise to be audible over greater distances than higher frequency noise. By concentrating on sound pressure alone, it ignores the increased annoyance of particular noises, especially that associated with AM. It is also the only guidance anywhere in the world which permits a higher sound level at night than during the day, completely contrary to common sense, noise pollution legislation and WHO guidelines.

4.2.4. Stigwood (2009) has shown that large turbines (hub heights 50-100m) are more likely than smaller turbines (hub height 30m) to cause excessive amplitude modulation, increased likelihood of low frequency noise and greater disturbance inside buildings. Internal noise can modulate over 15-20dB, changes which are easily perceived. This is probably due to different wind speeds and atmospheric conditions at these heights. He concludes that ETSU-R-97, which was developed for smaller turbines is inappropriate for large turbines.

4.2.5. Bullmore (2009) concluded that measuring wind speed at a single, low height, as required by ETSU-R-97, does not permit an accurate calculation of turbine and ambient noise.

4.2.6. Despite, or because of, ETSU-R-97, complaints of noise disturbance from industrial wind turbines continue and it is clear that ETSU-R-97 can not be relied upon to prevent sleep disturbance in those living near wind turbines.

To quote Mr Peter Hadden in evidence to the House of Lords Economic Affairs Committee:

"There is material evidence available to show that ETSU R 97 has failed to provide a reasonable level of protection to family homes from unbearable noise pollution where wind turbines are located too close to homes. Symptoms include sleep disturbances and deprivation, sometimes so severe that families are forced to evacuate their homes in order to stabilise well-being and to resume normal family life. This is a worldwide phenomenon where wind turbines are located too close to homes."

4.2.7. Planners should note also that the application of ETSU-R-97 is advisory in PPS22, not mandatory (*should* not *must*). It is also subordinate to the precautionary principle set out in PPS 23 (see below). Rather than rely on a provenly inadequate set of theoretical calculations to determine setback distance it is logical to look at the real world and the relationship between setback and noise complaints from existing sites. Human senses and opinion are used to judge visual impact. It is therefore consistent and logical to rely on human senses and opinion in respect of noise impact. Many of these sites causing problems have been in place for several years. The application by Nuon is for larger turbines than have been previously erected in the UK and thus allowance must be made for their additional noise in determining setback.

4.2.8. While it may be possible to produce a reasonable acoustically based theoretical approach to calculating set back distances (Kamperman and James 2008b), it makes more sense to rely on recommendations from observations of the effects on real people at established wind farms.

4.3. Swinford

4.3.1. The prevailing wind in South Leicestershire is from the south west and the village of Swinford is thus up wind of the proposed turbines. However, for about 20% of the year, the wind is from the north east. Under these conditions, the background noise in the village diminishes markedly as the M1/A14 and Catthorpe interchange is now down wind. Stable wind conditions with increased wind shear is equally likely to occur in any wind direction and occur to a level greater than that allowed for in ETSU-R-97.

4.3.2. Under the conditions of a north easterly wind and stable wind conditions, the residents of the village of Swinford which is only 800-1000 meters from the proposed turbines will be at much greater risk of sleep disturbance from lower than average background noise levels and greater than predicted turbine noise levels.

4.4. Conclusions

4.4.1. **Table 1** (see end of text) shows recommendations for setback distance by a number of authorities. References can be found in the Bibliography. In general, noise engineers recommend lesser setback distances than physicians. The former rely more on measured and/or calculated sound pressures and the latter on clinical reports. It is logical to prefer the actual reports of the humans subjected to the noise rather than abstract calculations, even if the latter accurately measure ambient noise and allow for the low frequency components of wind turbine noise. **Calculations can not measure annoyance and sleep disturbance, only humans can do so.**

4.4.2. A setback distance of at least 1.5km is necessary to ensure, with a reasonable degree of confidence, that the wind turbine noise will not disturb the sleep of those living in proximity to the proposed Swinford development.

5. Planning considerations

5.1. PPS22

5.1.1. PPS22 was promulgated subsequent to ETSU-R-97 and should therefore take precedence. Section 41 states: *"Development proposals should demonstrate any environmental, economic and social benefits as well as how any environmental and social impacts have been minimised through careful consideration of location, scale, design and other measures."* and *"Local planning authorities should ensure that renewable energy developments have been located and designed in such a way to minimise increases in ambient noise levels."*

5.1.2. Proposals that seek to place turbines within 1.5km of habitation have not sought to minimise environmental and social impact by wind turbine noise and its effects on sleep and health. They are therefore in contravention of PPS22.

5.1.3. The Companion Guide to PPS22 states *"RE 3 describes Factors to be considered in Planning for Wind Farms. These include: residential amenity (on noise and visual grounds); safe separation distances;"* and *"Well-specified and well-designed wind farms should be located so that increases in ambient noise levels around noise-sensitive developments are kept to acceptable levels with relation to existing background noise."*

5.1.4. Proposals that site wind turbines within 1.5km of habitation will not keep wind turbine noise to an acceptable level and are therefore in contravention of PPS22.

5.2. PPS7

5.2.1. PPS7 states:

5.2.2. *"ensuring people have decent places to live by improving the quality and sustainability of local environments and neighbourhoods"*

5.2.3. *"All development in rural areas should be well designed and inclusive, in keeping and scale with its location, and sensitive to the character of the countryside and local distinctiveness"*

5.2.4. *"have regard to the amenity of any nearby residents or other rural businesses that may be adversely affected by new types of on-farm development"*

5.2.5. Section 15 states: *"Planning authorities should continue to ensure that the quality and character of the wider countryside is protected and, where possible, enhanced."*

5.2.6. Proposals which site wind turbines within 1.5km of residential dwellings can not be said to enhance the quality of the countryside nor have regard to the amenity of local residents and must be rejected.

5.3. PPS23

5.3.1. PPS23 states:

5.3.2. *"the precautionary principle should be invoked when:*

- *there is good reason to believe that harmful effects may occur to human, animal or plant health, or to the environment*
- *the level of scientific uncertainty about the consequences or likelihood of the risk is such that best available scientific advice cannot assess the risk with sufficient confidence to inform decision-making."*

5.3.3. Application of ETSU R 97 is subordinate to the commitment to the Precautionary Principle outlined in PPS23. The objections to ETSU R 97 are so fundamental and the concerns regarding its validity so great, as is the evidence of human harm, that the precautionary principle must be invoked and consequently PPS 23 and EVI23 applied and permission refused on that account.

5.4 East Midlands Regional Spatial Strategy (RSS8)

5.4.1. Policy 41 states: *"In establishing criteria for onshore wind energy Development Plans and future Local Development Frameworks, should give particular consideration to: the effect on the built environment (including noise intrusion)."*

5.4.2. Proposals that site wind turbines within 1.5km of residential dwellings do not give sufficient consideration to the noise effects on the built environment and are therefore in contravention of RSS8.

5.5. Harborough District Local Plan

5.5.1. Harborough District Local Plan states that:

5.5.2. *"the district council will grant planning permission for the development of renewable energy schemes provided that they do not have an unacceptable impact on the landscape, features of historic and archaeological interest, nearby land use, residential amenity……."*

5.5.3. *"...proposals should not adversely affect the established character of the surrounding area in terms of scale, space around buildings, density, design, colour and texture of materials"*

5.5.4. *"...new development should not adversely affect the amenities of neighbouring users..."*

5.5.5. Policy EV/5 states: *"The district council will refuse planning permission for development proposals in the countryside unless the following criteria are met:*

- *The development does not adversely affect the character and appearance of the countryside*
- *The development does not adversely affect the amenities of the residents of the area*
- *Any new buildings are sited in a position that minimises their impact on the landscape and on important views into and out of villages"*

5.5.6. Clearly, any development which places wind turbines within 1.5km of residential dwellings will adversely affect the amenity of the residents and must be rejected.

5.5.7. Policy EV/23 states: *"the District Council will impose conditions on planning permissions to ensure that the development does not have an adverse effect on the character of its surroundings or harm the amenities of nearby users, through noise...If the District Council is not satisfied that these adverse effects would be overcome by the imposition of conditions, planning permission will not be granted"*

5.5.8. The evidence presented in this paper provides incontrovertible proof that wind turbines emit levels of noise harmful to human health and wellbeing. ETSU R 97 does not provide sufficient protection for residents as has been amply demonstrated by several leading researchers.

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5.6 Leicestershire, Leicester and Rutland Structure Plan 1996-2016 Resource Management Policy 1

5.6.1. LLRSP 1996-2016 states: *"All new development will minimise or avoid air, noise, water, land and light pollution"*

5.6.2. Developments within 1.5km of residential dwellings engender several types of pollution: noise, light (the likelihood of aviation lights) and shadow flicker, and will certainly not be minimised.

6. Overall Conclusions

7.1. The only mitigation of sleep disturbance from industrial wind turbine noise is a setback of at least 1.5km and probably greater. This estimate is based on data from present installations, many of which have a much smaller rated capacity than those proposed by Nuon. Most of the village of Swinford as well as outlying properties are within 1-1.5km of the proposed site and there is therefore a very high risk that a large proportion of residents would be adversely affected. **The application must be rejected.**

CD Hanning

14th June 2009

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Figure 1. Sound level and annoyance for different noise sources (van den Berg 2008)

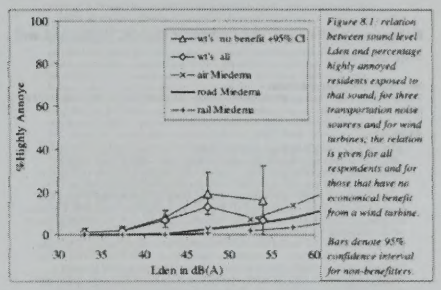
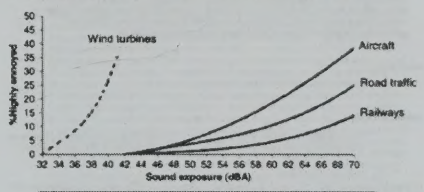


Figure 8.1: relation between sound level Lden and percentage highly annoyed residents exposed to that sound, for three transportation noise sources and for wind turbines; the relation is given for all respondents and for those that have no economical benefit from a wind turbine. Bars denote 95% confidence interval for non-benefitters.

Figure 2. Sound level and annoyance for different noise sources (Pedersen E and Persson Waye, 2004)



Sound exposure is for wind turbines calculated A-weighted L_{eq} for a hypothetical time period and for transportation DNL.

Table 1. Recommendations for setback of residential properties from industrial wind turbines

Note 1: The zero (not from) edges of towns and villages deemed to have been set more for visual than noise reasons

Authority	Year	Notes	Recommendation	
			Miles	Kilometres
Frey & Hadden	2007	Scientists. Turbines >2MW	>1.24	>2
Frey & Hadden	2007	Scientists. Turbines <2MW	1.24	2
Harry	2007	UK Physician	1.5	2.4
Pierpont	2008	US Physician	1.5	2.4
Welsh Affairs Select Committee	1994	Recommendation for smaller turbines	0.93	1.5
Scottish Executive	2007	See note 1	1.24	2
Adams	2006	US Lawyer	1.55	2.5
Bowdler	2007	UK Noise engineer	1.24	2
French National Academy of Medicine	2006	French physicians	0.93	1.5
The Noise Association	2006	UK scientists	1	1.6
Kamperman & James	2008	US Noise engineers	> 62	>1
Kamperman	2008	US Noise engineer	>1.24	>2
Bennett	2008	NZ Scientist	>0.93	>1.5
Acoustic Ecology Institute	2009	US Noise engineers	0.93	1.5

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Responses of the ear to low frequency sounds, infrasound and wind turbines

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Abstract

Infrasonic sounds are generated internally in the body (by respiration, heartbeat, coughing, etc) and by external sources, such as air conditioning systems, inside vehicles, some industrial processes and, now becoming increasingly prevalent, wind turbines. It is widely assumed that infrasound presented at an amplitude below what is audible has no influence on the ear. In this review, we consider possible ways that low frequency sounds, at levels that may or may not be heard, could influence the function of the ear. The inner ear has elaborate mechanisms to attenuate low frequency sound components before they are transmitted to the brain. The auditory portion of the ear, the cochlea, has two types of sensory cells; inner hair cells (IHC) and outer hair cells (OHC), of which the IHC are coupled to the afferent fibers that transmit "hearing" to the brain. The sensory stereocilia ("hairs") on the IHC are "fluid coupled" to mechanical stimuli, so their responses depend on stimulus velocity and their sensitivity decreases as sound frequency is lowered. In contrast, the OHC are directly coupled to mechanical stimuli, so their input remains greater than for IHC at low frequencies. At very low frequencies the OHC are stimulated by sounds at levels below those that are heard. Although the hair cells in other sensory structures such as the saccule may be tuned to infrasonic frequencies, auditory stimulus coupling to these structures is inefficient so that they are unlikely to be influenced by airborne infrasound. Structures that are involved in endolymph volume regulation are also known to be influenced by infrasound, but their sensitivity is also thought to be low. There are, however, abnormal states in which the ear becomes hypersensitive to infrasound. In most cases, the inner ear's responses to infrasound can be considered normal, but they could be associated with unfamiliar sensations or subtle changes in physiology. This raises the possibility that exposure in the infrasound component of wind turbine noise could influence the physiology of the ear.

Keywords

Noise; infrasound; windmill; wind turbine syndrome

Introduction

The increasing use of wind turbines as a "green" form of energy generation is an impressive technological achievement. Over time, there have been rapid increases in the size of the rotors, blades, and generator capacity of wind turbines, as well as a dramatic increase in their numbers. Associated with the deployment of wind turbines, however, has been a rather unexpected development. Some people are very upset by the noise that some wind turbines produce. Wind turbine noise becomes annoying at substantially lower levels than other forms of transportation noise, with the exception of railroad shunting yards (Pedersen and Persson Waye, 2004, Pedersen and Persson Waye, 2007; Pedersen et al, 2009). Some people with wind turbines located close to their homes have reported a variety of clinical symptoms that in rare cases are severe enough in force them to move away. These symptoms include sleep disturbance, headaches, difficulty concentrating, irritability and fatigue, but also include a number of otologic symptoms including dizziness or vertigo, tinnitus and the sensation of aural pain or pressure (Harry, 2007; Pierpont, 2009). The symptom group has been colloquially termed "wind turbine syndrome" and speculated to result from the low-frequency sounds that wind turbines generate (Pierpont, 2009). Similar symptoms resulting from low frequency sound emissions from non-wind turbine sources have also been reported (Feldmann and Pitten, 2004).

On the other hand, engineers associated with the wind industry maintain that infrasound from wind turbines is of no consequence if it is below the audible threshold. The British Wind Energy Association (2010), states that sounds from wind turbines are in the 30–50 dBA range, a level they correctly describe as difficult to discern above the rustling of trees [i.e. leaves].

This begs the question of why there is such an enormous discrepancy between subjective reactions to wind turbines and the measured sound levels. Many people live without problems near noisy intersections, airports and factories where sound levels are higher. The answer may lie in the high infrasound component of the sound generated by wind turbines. A detailed review of the effects of low frequency noise on the body was provided by Leventhall (2009). Although it is widely believed that infrasound from wind turbines cannot affect the ear, this view fails to recognize the complex physiology that underlies the ear's response to low frequency sounds. This review considers the factors that influence how different components of the ear respond to low frequency stimulation and specifically whether different sensory cell types of the inner ear could be stimulated by infrasound at the levels typically experienced in the vicinity of wind turbines.

The Physics of Infrasound

Sounds represent fluctuating pressure changes superimposed on the normal ambient pressure, and can be defined by their spectral frequency components. Sounds with frequencies ranging from 20 Hz to 20 kHz represent those typically heard by humans and are designated as falling within the audible range. Sounds with frequencies below the audible range are termed infrasound. The boundary between the two is arbitrary and there is no physical distinction between infrasound and sounds in the audible range other than their frequency. Indeed, infrasound becomes perceptible if presented at high enough level.

The level of a sound is normally defined in terms of the magnitude of the pressure changes it represents, which can be measured and which does not depend on the frequency of the sound. In contrast, for sounds of constant pressure, the displacement of the medium is inversely proportional to frequency, with displacements increasing as frequency is reduced. This phenomenon can be observed as the difference in vibration amplitude between a subwoofer generating a low frequency tone and a tweeter generating a high frequency tone at the same pressure level. The speaker cone of the subwoofer is visibly displaced while the displacement of the tweeter cone is imperceptible. As a result of this phenomenon, vibration amplitudes to infrasound are larger than those to sounds in the auditory range at the same level, with displacements at 1 Hz being 1000 times those at 1 kHz when presented at the same pressure level. This corresponds to an increase in displacement at a rate of 6 dB/octave as frequency is lowered.

Overview of the anatomy of the ear

The auditory part of the inner ear, the cochlea, consists of a series of fluid-filled tubes, spiraling around the auditory nerve. A section through the middle of a human cochlea is shown in Fig 1A. The anatomy of each turn is characterized by three fluid-filled spaces (Fig 1B): scala tympani (ST) and scala vestibuli (SV) containing perilymph (yellow), separated by the endolymphatic space (ELS;blue). The two perilymphatic compartments are connected together at the apex of the cochlea through an opening called the helicotrema. Perilymph is similar in ionic composition to most other extracellular fluids (high Na^+, low K^+) while endolymph has a unique composition for an extracellular fluid in the body, being high in K^+ and low in both Na^+ and Ca^{++}. It is also electrically polarized by about +80 mV with respect to perilymph, which is called the endocochlear potential (EP). The main sensory organ of the cochlea (Figs 1C,D,IE, and shown colored green in Fig 1D) lies on the basilar membrane between the ELS and the perilymph of ST and is called the organ of Corti. The organ of Corti, seen here in cross section, contains one row of inner hair cells (IHC) and three rows of outer hair cells (OHC) along the spiral length of the cochlea. As shown schematically in Fig 1F, the sensory hairs (stereocilia) of the OHC have a gradation in length, with the tallest stereocilia embedded in the gelatinous tectorial membrane (TeM) which overlies the organ of Corti in the endolymphatic space (Kimura 1975). This arrangement allows sound-evoked displacements of the organ of Corti to be converted to a lateral displacement of OHC stereocilia. In contrast, the stereocilia of the IHC do not contact the tectorial membrane, but remain within the fluid of the subtectorial space (Kimura 1975,Lim 1986). Because of this difference in how the hair cell stereocilia interact with the TeM, the two types of hair cell respond differently to mechanical stimuli. At low frequencies, the IHC respond according to the velocity of basilar membrane displacement, while OHC respond to the displacement itself (Russell and Sellick, 1983;Dallos, 1984).

The two types of hair cells also contact different types of afferent nerve fibers, sending information to the brain (Spoendlin, 1972; Santi and Tsuprun, 2001). Each IHC is innervated by multiple Type I afferent fibers, with each fiber innervating only a single IHC. The Type I afferents represent the vast majority (95%) of the fibers transmitting information to the brain and as a result it is generally believed that mammals hear with their IHC (Dallos, 2008). In contrast, the OHC contact Type II afferent fibers, which are unmyelinated and make synaptic contacts with a number of OHC. Type II afferents fibers are believed to be unresponsive to sounds and may signal the static position of the organ of Corti (Brown, 1994; Robertson et al., 1999). The OHC also receive substantial efferent innervation (from the brain) while the IHC receive no direct efferent innervation (Spoendlin, 1972).

Mechanics of low frequency stimulation

Infrasound entering the ear through the ossicular chain is likely to have a greater effect on the structures of the inner ear than is sound generated internally. The basic principles underlying stimulation of the inner ear by low frequency sounds are illustrated in Figure 2. Panel A shows the compartments of a simplified, uncoiled cochlea bounded by solid walls with two parallel fluid spaces representing SV and ST respectively that are separated by a distensible membrane representing the basilar membrane and organ of Corti. It is generally agreed that the differential pressure between SV and ST across the basilar membrane is the important factor driving the motion of the basilar membrane (von Békésy 1960;Dancer and Franke, 1980;Nakajima et al., 2008;Merchant and Rosowski, 2008). In example A, all the

boundaries of the inner ear are solid and noncompliant with the exception of the stapes. In this non-physiologic situation, the stapes applies pressures to SV (indicated by the red arrows) but as the fluid can be considered incompressible, pressures are instantaneously distributed throughout both fluid spaces and pressure gradients across the basilar membrane will be small. In panel B, the round window (RW) and the cochlear aqueduct (CA) have been added to the base of ST. For frequencies below 300 Hz the RW provides a compliance between perilymph and the middle ear (Nakajima et al., 2008) and the CA provides fluid communication between perilymph and the cerebrospinal fluid (CSF). Under this condition, pressures applied by the stapes induce small volume flows between the stapes and the site(s) of compliance (blue arrows) which requires a pressure gradient to exist along the system, as indicated by the shading. The pressure differential across the basilar membrane will displace it, causing stimulation of the IHC and OHC. This is the situation for external sounds entering the normal cochlea via the ossicular chain. In panel C the situation is compared for sounds originating in the CSF and entering the system through the CA. In this case, the compliant RW is situated close to the location of aqueduct entry, so the major fluid flows and pressure gradients occur locally between these structures. As the stapes and other boundaries in scala vestibuli and the vestibule are relatively noncompliant, pressure gradients across the basilar membrane will be lower than with an equivalent pressure applied by the stapes. For infrasonic frequencies, it was shown that responses at 1 Hz pressure oscillation applied to the fluid in the basal turn of ST were substantially increased when the wall of SV was perforated thereby providing greater compliance in that scala (Salt and DeMott, 1999).

The final condition in Figure 2D shows the consequences of a "third window" on the SV/vestibule side of the cochlear partition. This causes an increased "air-bone gap" (i.e. an increase in sensitivity to bone conducted vibration and a decreased sensitivity to air conducted sounds, primarily at low frequencies; Merchant and Rosowski, 2008). It may also produce an abnormal sound-induced stimulation of other receptors in the inner ear, such as the hair cells in the ampulla of the semicircular canal. This is the basis of the Tullio phenomenon, in which externally or internally generated sounds, such as voice, induce dizziness.

Receptors in other organs of the inner ear, specifically both the saccule and the utricle also respond to airborne sounds delivered by the stapes, as discussed in more detail below. The mechanism of hair cell stimulation of these organs is less certain, but is believed to be related to pressure gradients through the sensory epithelium (Sohmer 2006).

Physiologic responses of the ear to low frequency stimuli

i) Cochlear Hair Cells

When airborne sounds enter the ear, to be transduced into an electrical signal by the cochlear hair cells, they are subjected to a number of mechanical and physiologic transformations, some of which vary systematically with frequency. The main processes involved were established in many studies and were summarized by Cheatham and Dallos (2001). A summary of the components are shown in Figure 3. There are three major processes influencing the sensitivity of the ear to low frequencies. The first arises from the transmission characteristics of sounds through the ossicular structures of the middle ear, which have been shown to attenuate signals at a rate of 6 dB/octave for frequencies below 1000 Hz (Dallos, 1973). As the vibration amplitude in air increases at 6 dB/octave as frequency is lowered, this attenuation characteristic of middle ear transmission results in the displacement of middle ear structures remaining almost constant across frequency for sounds of constant pressure level. A second process attenuating low frequency sounds is the fluid shunting between ST and SV through the helicotrema. The helicotrema has been

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shown) to attenuate frequencies below 100 Hz by 6 dB/octave (Dallos 1970). The third filter arises from the demonstrated dependence of the IHC on stimulus velocity, rather than displacement (Dallos, 1984). This results in an attenuation of 6 dB/octave for frequencies below approximately 470 Hz for the IHC, and causes a 90° phase difference between IHC and OHC responses (Dallos, 1984). The combined results of these processes are compared with the measured sensitivity of human hearing (ISO 226:2003) in Fig. 3D. The three processes combine to produce the steep decline of sensitivity (up to 18 dB/octave) in human hearing for frequencies between 100 and 20 Hz. This steep cutoff means that to hear a stimulus at 5 Hz it must be presented at 105 dB higher level than one at 500 Hz. This reflects the fact that the predominant, type I afferent fibers are stimulated by the IHC and that mammals hear with their IHC (Dallos 2008). However, an important consequence of this underlying mechanism is that the OHC and IHC differ markedly in their responses to low frequency stimuli. As the OHC respond in displacement, rather than velocity, they are not subject to the 6dB/octave attenuation seen by IHC, so at low frequencies they are stimulated by lower sound levels than the IHC. In theory, the difference between IHC and OHC responses will increase as frequency decreases (becoming over 50 dB at 1 Hz), but in practice, there is interaction between the two types of hair cells which limits the difference as discussed below.

The measured response phase of OHC, IHC and auditory nerve fibers is consistent with the above processes. The cochlear microphonics (CM) recorded in the organ of Corti with low frequency stimuli are in phase with the intracellular potentials of the OHC. This supports the view that the low-frequency CM is dominated by OHC-generated potentials, which follow the displacement of the basilar membrane (Dallos et al., 1972). In contrast, intracellular responses from the IHC lead the organ of Corti CM response by an amount which approaches 90° as frequency is reduced to 100 Hz (Dallos, 1984) corresponding to maximal basilar membrane velocity towards SV (Nuttall et al., 1981). As frequency is lowered, the intracellular potentials of IHC and afferent fiber responses show phase changes consistent with the IHC no longer responding to the increasingly attenuated velocity stimulus, but instead responding to the extracellular potentials generated by the OHC (Sellick et al., 1982, Cheatham and Dallos 1997). A similar change of phase as frequency is lowered was reported in human psychophysical measurements (Zwicker 1977) with masking patterns differing by approximately 90° for frequencies above and below ~40 Hz. This transition from a response originating from mechanical stimulation of the IHC, to one originating from electrical stimulation of the IHC by large extracellular responses from the OHC may account for the transition of low frequency sensitivity in humans from 18 dB/octave above 20 Hz to 12 dB/octave below 10 Hz (Møller and Pedersen, 2004) (Fig 3D). Near 10 Hz the IHC transition to become primarily stimulated by the more sensitive OHC responses. It can be inferred that if extracellular voltages generated by the OHC are large enough to electrically stimulate the IHC at a specific frequency and level, then the lowest level that the OHC respond to at that frequency must be substantially lower. Based on this understanding of how the sensitivity of the ear arises, one conclusion is that at low frequencies the OHC are responding to infrasound at levels well below those that are heard. On the basis of the calculated input to OHC in Figure 3b, it is possible that for frequencies around 5 Hz, the OHC could be stimulated at levels up to 40 dB *below* those that stimulate the IHC. Although the OHC at 1 kHz are approximately 12 dB less sensitive than IHC (Dallos 1986), this difference declines as frequency is low-ered and differences in hair cell sensitivity at very low frequencies (below 200 Hz) have not been measured.

Much of the work understanding how the ear responds to low frequency sounds is based on measurements performed in animals. Although low frequency hearing sensitivity depends on many factors including the mechanical properties of the middle ear, low frequency hearing sensitivity has been shown to be correlated with cochlear length for many species with non-

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on the un-stalled operating point of the cochlear transducer, which can be derived by Boltzmann analysis of the CM waveform (Patuzzi and Moleirinho 1998; Patuzzi and O'Beirne 1999). The operating point can be regarded as the resting position of the organ of Corti or its position during zero crossings of an applied stimulus (which may not be identical, as stimulation can itself influence operating point). Small displacements of operating point have a dramatic influence on even-order distortions generated by the cochlea ($2f_1$, f_2–f_1) while having little influence on odd-order distortions ($2f_1$–f_2) until displacements are large (Frank and Kössl 1996; Sirjani et al, 2004). Low frequency sounds (so called bias tones) have been shown to modulate distortion generated by the ear by their displacement of the operating point of the organ of Corti (Brown et al., 2009). In normal guinea pigs, 4.8 Hz bias tones at levels of 85 dB SPL have been shown to modulate measures of operating point derived from an analysis of CM waveforms (Brown et al, 2009; Salt et al, 2009). This is a level that is substantially below the expected hearing threshold of the guinea pig at 4.8 Hz. In animals where the helicotrema was occluded by injection of gel into the perilymphatic space at the cochlear apex, even lower bias levels (down to 60 dB SPL) modulate operating point measures (Salt et al., 2009). These findings are again consistent with the OHC being the origin of the signals measured and the OHC being more responsive to low frequency sounds than the IHC. A similar hypersensitivity to 4.8 Hz bias tones was also found in animals with surgically-induced endolymphatic hydrops (Salt et al., 2009). This was thought to be related to the occlusion of the helicotrema by the displaced membranous structures bounding the hydropic endolymphatic space in the apical turn. In some cases of severe hydrops, Reissner's membrane was seen to herniate into ST. As endolymphatic hydrops is present both in patients with Meniere's disease and in a significant number of asymptomatic patients (Merchant et al., 2005), the possibility exists that some individuals may be more sensitive to infrasound due the presence of endolymphatic hydrops.

In the human ear, most studies have focussed on the $2f_1$–f_2 distortion product, as even-order distortions are difficult to record in humans. The $2f_1$–f_2 component has been demonstrated to be less sensitive to operating point change (Sirjani et al., 2004; Brown et al, 2009). Using different criteria of bias-induced distortion modulation, the dependence on bias frequency was systematically studied in humans for frequencies down to 25 Hz, 6 Hz and 15 Hz respectively (Bian and Scherer, 2007; Hensel et al, 2007; Marquardt et al, 2007). In each of these studies, the bias levels required were above those that are heard by humans, but in all of them the change of sensitivity with frequency followed a substantially lower slope than the hearing sensitivity change as shown in Figure 5. Again this may reflect the OHC origins of acoustic emissions, possibly combined with the processes responsible for the flattening of equal loudness contours for higher level stimuli, since the acoustic emissions methods are using probe stimuli considerably above threshold. Although in some regions, slopes of 9–12 dB/octave were found, all showed slopes of 6 dB/octave around the 20 Hz region where human hearing falls most steeply at 18 dB/octave. It should also be emphasized that each of these studies selected a robust modulation criterion and was not specifically directed at establishing a threshold for the modulation response at each frequency. Indeed, in the data of Bian and Scherer (2007) (their Figure 3), significant modulation can be seen at levels down to 80 dB SPL at some of the test frequencies. In one of the studies (Marquardt et al, 2007) equivalent measurements were performed in guinea pigs. Although somewhat lower slopes were observed in guinea pigs it is remarkable that stimulus levels required for modulation of distortion were within 5–10 dB of each other for guinea pigs and humans across most of the frequency range. In this case the guinea pig required lower levels than the human. Although the threshold of sensitivity cannot be established from these studies, it is worth noting that for distortion product measurements in the audible range, "thresholds" typically require stimulus levels in the 35–45 dB SPL range (Lonsbury-Martin et al, 1990). In the Marquardt

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specialized cochleae, including humans and guinea pigs (West, 1985; Echteler et al., 1994). The thresholds of guinea pig hearing have been measured with stimulus frequencies as low as 50 Hz, as shown in Fig 4A. The average sensitivity at 125 Hz for five groups in four studies (Herlitze et al., 1975; Miller and Murray, 1976; Wallhäusser and Taylor-Spires, 1976; Prosen et al, 1978; Fay, 1988) was 37.9 dB SPL, which is 17.6 dB less sensitive than the human at the same frequency and is consistent with the shorter cochlea of guinea pigs. In the absence of data to the contrary, it is therefore reasonable to assume that if low frequency responses are present in the guinea pig at a specific level, then they will be present in the human at a similar or lower stimulus level.

ii) Cochlear microphonic measurements

Cochlear microphonics (CM) to low frequency tones originate primarily from the OHC (Dallos et al., 1972; Dallos and Cheatham, 1976). The sensitivity of CM as frequency is varied is typically shown by CM isopotential contours, made by tracking a specified CM amplitude as frequency is varied. Figure 4D shows low frequency CM sensitivity with two different criteria (Dallos 1973: 3 μV; Salt at al, 2009: 500 μV). The decrease in CM sensitivity as frequency is lowered notably follows a far lower slope than that of human hearing over the comparable frequency range. In the data from Salt et al., (2009), the stimulus level differences between 5 Hz and 500 Hz average only 34 dB (5.2 dB/octave), compared to the 105 dB difference (15.8 dB/octave) for human hearing over the same range. Although these are suprathreshold, extracellular responses, based on an arbitrary amplitude criterion, these findings are consistent with the OHC having a lower rate of cutoff with frequency than the IHC, and therefore responding to lower level stimuli at very low frequencies.

The measured change in CM sensitivity with frequency may include other components, such as a contribution from transducer adaptation at the level of the OHC stereocilia (Kros, 1996). Kennedy et al. (2003) have suggested that adaptation of the mechanoelectrical transducer channels is common in all hair cells and contributes to driving active motion of the hair cell bundle. Based on their measurements in cells isolated from the apical turns of neonatal rats, they estimated that adaptation caused high-pass filtering with a low frequency cutoff frequency of 2/3 of the best frequency for the cochlear location. This type of adaptation, however, does not appear to provide additional attenuation at very low frequencies, as inferred from CM sensitivity curves measured down to 5 Hz. On the contrary, the CM sensitivity curve appears to flatten below 10 Hz, a phenomenon which is currently under investigation in our laboratory.

Figure 4C shows the influence of plugging the helicotrema with gel on CM sensitivity with frequency, recorded from the basal turn of a guinea pig with a 500 μV criterion (Salt et al., 2009). These relative sensitivity changes, combined with a 90° phase shift in responses, replicate those of Franke and Dancer (1982) and demonstrate the contribution to attenuation provided by the helicotrema for frequencies below approximately 100 Hz. This contrasts with a prior suggestion that the helicotrema of the guinea pig was less effective than that of other species (Dallos, 1970). While the above CM measurements were made with the bulla open, measurements made in both the bulla open-closed conditions with closed sound-field stimulation suggest there is no pronounced frequency-dependence of the difference between these conditions below 300 Hz although there may be a level difference of 5–15 dB (Dallos 1973; Wilson & Johnstone 1975).

iii) Low frequency biasing, operating point, and distortion generation

As a result of the saturating, nonlinear transducer characteristic of cochlear hair cells (Russell and Sellick, 1993; Kros 1996), the fidelity of cochlear transduction depends highly

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study, the bias tone level required at 500 Hz is over 60 dB above hearing threshold at that frequency.

iv) Feedback mechanisms stabilizing operating point

The OHC not only transduce mechanical stimuli to electrical responses, but also respond mechanically to electrical stimulation (reviewed by Dallos 2008) in a manner that provides mechanical amplification. This "active tuning" primarily enhances responses to high stimulus frequencies and is thought to provide little or no active gain with stimuli below approximately 1 kHz (Sellick et al., 2006). For low frequency stimulation, however, basilar membrane modulation by the low frequency tone does have a major influence on the mechanics at the best frequency of high frequency tones i.e. on the active tuning process (Patuzzi et al., 1984). It has been suggested that slow mechanical movements of the OHC may play a part in stabilizing the operating point of the transducer (LePage 1987; LePage 1989) so the OHC may participate in an active cancellation of low frequency sounds. In models of the cochlear transducer, it was proposed that negative feedback occurred at low frequencies (in which the OHC opposed movements of the basilar membrane), which becomes a positive feedback at the best frequency for the region (Mountain et al., 1983). Chan and Hudspeth (2005) have also suggested OHC motility may be exploited to maintain the operating point of a fast amplifier in the hair cell bundle. However, this possibility has recently been questioned (Dallos 2010) for a number of reasons, one of which is the somatic motor protein, prestin, has an extremely fast response capability. So the interrelationships between hair cell motility and transduction, and between OHC and IHC remain an intense focus of current research. For low frequencies, it has been shown that an out-of-phase motion exists between the IHC reticular lamina and the overlying TM so that electromechanical action of the OHC may stimulate the IHC directly, without involvement of the basilar membrane (Nowotny and Gummer, 2006). The possible roles of the OHC and efferent systems are made more complex by recent findings of reciprocal synapses between OHC and their efferent terminals, seen as afferent and efferent synapses on the same fiber (Thiers et al., 2008). One explanation for this system is that the synapses may locally (without involvement of the central nervous system) coordinate the responses of the OHC population so that optimum operating point is maintained for high frequency transduction. There is some evidence for active regulation of operating point based on the biasing of acoustic emission amplitudes by low frequency tones in which a "hysteresis" was observed (Dian et al, 2004). The hysteresis was thought to result from active motor elements, either in the stereocilia or the lateral wall of the OHC, shifting the transducer function in the direction of the bias. A similar hysteresis was also reported by Lukashkin and Russell (2005) who proposed that a feedback loop was present during the bias that keeps the operating point at its most sensitive region, shifting it in opposite directions during compression and rarefaction phase of the bias tone thereby partially counteracting its effects.

If there are systems in the cochlea to control operating point as an integral component of the amplification process, they would undoubtedly be stimulated in the presence of external infrasound.

v) Vestibular function

The otolith organs, comprising of the saccule and utricle, respond to linear accelerations of the head (Uzun-Coruhlu et al, 2007) and the semi-circular canals respond to angular acceleration. These receptors contribute to the maintenance of balance and equilibrium. In contrast to the hair cells of the cochlea the hair cells of the vestibular organs are tuned to very low frequencies, typically below 30 Hz (Grossman et al, 1988). Frequency tuning in vestibular hair cells results from the electrochemical properties of the cell membranes (Mankey, 2000; Art and Fettiplace, 1987) and may also involve active mechanical

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amplification of their stereociliary input (Hudspeth, 2008; Rabbitt et al., 2010). Although vestibular hair cells are maximally sensitive to low frequencies, they typically do not respond to airborne infrasound. Rather, they normally respond to mechanical inputs resulting from head movements and positional changes with their output controlling muscle reflexes to maintain posture and eye position. At the level of the hair cell stereocilia, although vibrations originating from head movements and low frequency sound would be indistinguishable, the difference in sensitivity lies in the coupling between the source (stimulus and the hair cell bundle. Head movements are efficiently coupled to the hair cell bundle, while acoustic stimuli are inefficiently coupled due middle ear characteristics and the limited pressure gradients induced within the structure with sound stimuli (Sohmer 2006). In a similar manner to cochlear hair cells, which respond passively (i.e. without active amplification) to stimuli outside their best frequency range, vestibular hair cells respond passively to stimuli outside their best frequency range. The otolith organs have been shown to respond to higher, acoustic frequencies delivered in the form of airborne sounds or vibration. This has been demonstrated in afferent nerve fiber recordings from vestibular nerves (Young et al., 1977; McCue and Guinan, 1994; Curthoys et al., 2006) and has recently gained popularity as a clinical test of otolith function in the form of vestibular-evoked myogenic potential (VEMP) testing (Todd et al, 2007; Zhou and Cox, 2004; Curthoys, 2010). These responses arise because higher frequency stimuli are more effectively coupled to the otolithic hair cells. But as sound or vibration frequency is reduced, its ability to stimulate the vestibular organs diminishes (Murofushi et al., 1999; Hullar et al., 2005; Todd et al, 2008). Sit for very low frequencies, even though the hair cell sensitivity is increasing as active tuning is invoked, mechanical input is being attenuated. While there have been many studies of vestibular responses to physiologic stimuli (i.e. head accelerations, rotations, etc) comprising of infrasonic frequency components, we are unaware of any studies that have directly investigated vestibular responses to airborne infrasound of similar frequency composition. As people do not become unsteady and the visual field does not blur when exposed to high level infrasound, it can be concluded that sensitivity is extremely low.

In some pathologic conditions, coupling of external infrasound may be greater. It is known that "third window" defects, such as superior canal dehiscence increase the sensitivity of labyrinthine receptors to sounds (Wit et al, 1985; Watson et al., 2000; Carey et al., 2004), and are exhibited as the Tullio phenomenon (see earlier section). To our knowledge, the sensitivity of such patients to controlled levels of infrasound has never been evaluated. In this respect, it needs to be considered that vestibular responses to stimulation could occur at levels below those that are perceptible to the patient. (Todd et al., 2008).

vi) Inner ear fluids changes

Some aspects of cochlear fluids homeostasis have been shown to be sensitive to low frequency pressure fluctuations in the ear. The endolymphatic sinus is a small structure between the saccule and the endolymphatic duct which has been implicated as playing a pivotal role in endolymph volume regulation (Salt 2005). The sinus has been shown to act as a valve, limiting the volume of endolymph driven into the endolymphatic sac by pressure differences across the endolymphatic duct (Salt and Rask-Andersen, 2004). The entrance of saccular endolymph into the endolymphatic sac can be detected either by measuring the K^+ concentration in the sac (as saccular endolymph has substantially higher K^+ concentration) or by measuring hydrostatic pressure. The application of a sustained pressure to the vestibule did not cause K^+ elevation or pressure increase in the sac, confirming that under this condition, flow was prevented by the membrane of the sinus acting as a valve. In contrast, the application of 5 cycles at 9 Hz to the external ear canal, caused a K^+ increase in the sac, confirming that oscillation of pressure applied to the sinus allowed pulses of

dominated by infrasound components, with energy increasing between 1000 Hz and 1 Hz (the lowest frequency that was measured) at a rate of approximately 5.5 dB/octave, reaching levels of approximately 90 dB SPL near 1 Hz. Sugimoto et al. (2008) reported a dominant spectral peak at 2 Hz with levels monitored over time reaching up to 100 dB SPL. Jung and Cheung (2008) reported a major peak near 1 Hz at a level of approximately 97 dB SPL. In most studies of wind turbine noise, this high level, low frequency noise is dismissed on the basis that the sound is not perceptible. This fails to take into account the fact that the OHC are stimulated at levels that are not heard.

Conclusions

The fact that some inner ear components (such as the OHC) may respond to infrasound at the frequencies and levels generated by wind turbines does not necessarily mean that they will be perceived or disturb function in any way. On the contrary though, if infrasound is affecting cells and structures at levels that cannot be heard this leads to the possibility that wind turbine noise could be influencing function or causing unfamiliar sensations. Long term stimulation of position-stabilizing or fluid homeostasis systems could result in changes that disturb the individual in some way that remains to be established. We realize that some individuals (such as fighter pilots) can be exposed to far higher levels of infrasound without undue adverse effects. In this review, we have confined our discussion to the possible direct influence of infrasound on the body mediated by receptors or homeostatic processes in the inner ear. This does not exclude the possibility that other receptor systems, elsewhere in the body could contribute to the symptoms of some individuals.

The main points of our analysis can be summarized as follows:

1. Hearing perception, mediated by the inner hair cells of the cochlea, is remarkably insensitive to infrasound.
2. Other sensory cells or structures in the inner ear, such as the outer hair cells, are more sensitive to infrasound than the inner hair cells and can be stimulated by low frequency sounds at levels below those that are heard. The concept that an infrasonic sound that cannot heard can have no influence on inner ear physiology is incorrect.
3. Under some clinical conditions, such as Menière's disease, superior canal dehiscence, or even asymptomatic cases of endolymphatic hydrops, individuals may be hypersensitive to infrasound.
4. A-weighting wind turbine sounds underestimates the likely influence of the sound on the ear. A greater effort should be made to document the infrasound component of wind turbine sounds under different conditions.
5. Based on our understanding of how low frequency sound is processed in the ear, and on reports indicating that wind turbine noise causes greater annoyance than other sounds of similar level and affects the quality of life in sensitive individuals, there is an urgent need for more research directly addressing the physiologic consequences of long-term, low level infrasound exposures on humans.

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endolymph to be driven from the sinus into the endolymphatic sac. The pressure changes driving these pulses was large, comparable to those produced by contractions of the tensor tympani muscle, as occurs during swallowing. Tensor tympani contractions produce displacements of the stapes towards the vestibule for a duration of approximately 0.5 s (~ 2 Hz), which induce large EP changes and longitudinal movements of endolymph within the cochlea (Salt and DeMott, 1999). The lowest sound level that drives endolymph movements is currently unknown.

A therapeutic device (the Meniett: www.meniett.com; Odkvist et al, 2000) that delivers infrasound to the inner ear is widely used to treat Menière's disease in humans (a disease characterized by endolymphatic hydrops). The infrasonic stimulus (6 Hz or 9 Hz) is delivered by the device in conjunction with sustained positive pressure in the external canal. An important aspect of this therapy, however, is that a tympanostomy tube is placed in the tympanic membrane before the device is used. The tympanostomy tube provides an open perforation of the tympanic membrane which shunts pressure across the structures, so that ossicular movements (and cochlear stimulation) are minimized, and the pressures are applied directly to the round window membrane. Nevertheless, the therapeutic value of this device is based on infrasound stimulation influencing endolymph volume regulation in the ear.

As presented above, endolymphatic hydrops, by occluding the perilymph communication pathway through the helicotrema, makes the ear more sensitive to infrasound (Salt et al, 2009). It has also been shown that non-damaging low frequency sounds in the acoustic range may themselves cause a transient endolymphatic hydrops (Flock and Flock, 2008; Salt 2004). The mechanism underlying this volume change has not been established and it has never been tested whether stimuli in the infrasound range cause endolymphatic hydrops.

Although infrasound at high levels apparently does not cause direct mechanical damage to the ear (Westin 1975, Jiruchon and Cook, 2007) in animal studies it has been found to exacerbate functional and hair cell losses resulting from high level exposures of sounds in the audible range (Harding et al., 2007). This was explained as possibly resulting from increased mixture of endolymph and perilymph around noise induced lesion sites in the presence of infrasound.

Wind turbine Noise

Demonstrating an accurate frequency spectrum of the sound generated by wind turbines creates a number of technical problems. One major factor that makes understanding the effects of wind turbine noise on the ear more difficult is the widespread use of A-weighting to document sound levels. A-weighting shapes the measured spectrum according to the sensitivity of human hearing, corresponding to the IHC responses. As we know the sensitivity for many other elements of inner ear related to the OHC do not decline at the steep slope seen for human hearing, then A-weighting considerably underestimates the likely influence of wind turbine noise on the ear. In this respect, it is notable that in none of the physiological studies in the extensive literature reporting cochlear function at low frequencies were the sound stimuli A-weighted. This is because scientists in these fields realize that shaping sound levels according to what the brain perceives is not relevant to understanding peripheral processes in the ear. A-weighting is also performed for technical reasons, because measuring unweighted spectra of wind turbine noise is technically challenging and suitable instrumentation is not widely available. Most common approaches to document noise levels (conventional sound level meters, video cameras, devices using moving coil microphones, etc) are typically insensitive to the infrasound component. Using appropriate instrumentation, Van den Berg (2006) showed that wind turbine noise was

Abbreviations

CA	cochlear aqueduct
CM	cochlear microphonic
CSF	cerebrospinal fluid
cVEMP	cervical vestibular evoked myogenic potential
EP	endocochlear potential
IHC	inner hair cell(s)
oVEMP	ocular vestibular evoked myogenic potential
OHC	outer hair cell(s)
RW	round window
ST	scala tympani
SV	scala vestibuli

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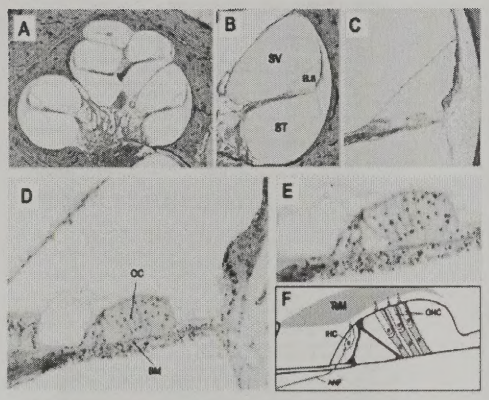

Figure 1.
Panels A–E Cross section through the human cochlea shown with progressively increasing magnifications. **Panels B and C** The fluid spaces containing perilymph have been colored yellow and endolymph blue. **Panel D** The sensory structure of the cochlea, the organ of Corti, is colored green. **Panel F** Schematic showing the anatomy of the main components of the organ of Corti. Abbreviations are: SV: scala vestibuli; ST: scala tympani; ELS: endolymphatic space; OC: organ of Corti; BM: basilar membrane; TeM: tectorial membrane; IHC: inner hair cell; OHC: outer hair cell; ANF: afferent nerve fiber. Original histological images courtesy of Saumil Merchant, MD, Otopathology Laboratory, Massachusetts Eye and Ear Infirmary and Harvard Medical School, Boston.

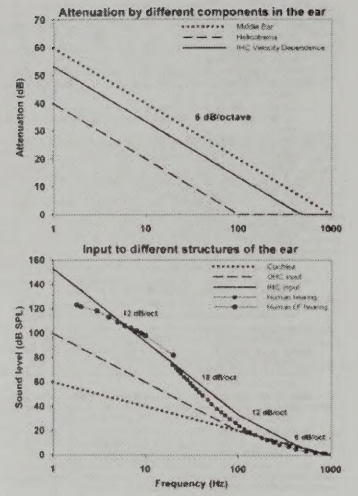

Figure 3.
Upper panel: Estimated properties of high pass filter functions associated with cochlear signal processing (based on Cheatham and Dallos, 2001). The curves show the low frequency attenuation provided by the middle ear (6 dB/octave below 1000 Hz), by the helicotrema (6 dB/octave below 100 Hz) and by the fluid coupling of the inner hair cells (IHC) resulting in the IHC dependence on stimulus velocity (6 dB/Octave below 470 Hz). **Lower panel:** Combination of the three processes above into threshold curves demonstrating: input to the cochlea (dotted) as a result of middle ear attenuation; input to the outer hair cells (OHC) as a result of additional filtering by the helicotrema; and input to the IHC as a result of their velocity dependence. Shown for comparison is the sensitivity of

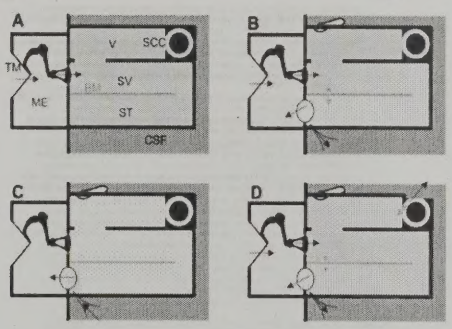

Figure 2.
Schematic representation of the uncoiled inner ear for four different mechanical conditions with low frequency stimulation. **Red** arrows indicate applied pressure and blue arrows indicate loss to compliant structures. **A:** indicates a hypothetical condition where the fluid space is rigidly bounded with no "windows" providing compliance. Sound pressure applied by the stapes causes uniform pressures (indicated by color shading) throughout the fluid space, so pressure difference across the basilar membrane and therefore stimulation is minimal. **B:** The normal situation with compliances provided by the round window and cochlear aqueduct at the base of scala tympani. Pressure differentials cause movement of fluid towards the compliant regions, a including a pressure differential across the basilar membrane causing stimulation. **C:** Situation where low frequency enters scala tympani through the cochlear aqueduct. The main compliant structure is located nearby so pressure gradients across the basilar membrane are small, limiting the amount of stimulation. Infrasound entering through the cochlear aqueduct (such as from respiration and body movements) therefore does not provide the same degree of stimulation as that entering via the stapes. **D:** Situation with compromised otic capsule, such as superior canal dehiscence. Air pressure gradients occur both along the cochlea and through the vestibule and semi-circular canal, the sensory structures in the semi-circular canal will be stimulated.
Abbreviations: BM: basilar membrane; CA: cochlear aqueduct; CSF: cerebrospinal fluid; ES: endolymphatic duct and sac; ME: middle ear; RW: round window; SCC: semi-circular canal; ST: scala tympani; SV: scala vestibuli; TM: tympanic membrane; V: vestibule. The endolymphatic duct and sac is not an open pathway but is closed by the tissues of the sac, so it is not considered a significant compliance.

human hearing in the audible range (ISO226:2003) and the sensitivity of humans to infrasounds (Møller and Pedersen, 2004). The summed filter functions account for the steep 18 dB/octave decrease in sensitivity below 100 Hz.

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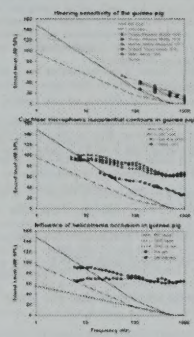


Figure 4.

Upper panel: Similar filter functions as Fig 3, with parameters appropriate for the guinea pig, and compared with measures of guinea pig hearing. At 125 Hz the guinea pig is approximately 18 dB less sensitive than the human (shown dotted for comparison). **Middle panel:** Cochlear microphonic isopotential contours in the guinea pig show no steep cutoff below 100 Hz, consistent with input to the OHC being maintained at lower levels than the IHC for low frequencies. **Lower panel:** Influence of helicotrema occlusion in the guinea pig, produced by injecting 2 μL of hyaluronate gel into the cochlear apex, on the CM input/output function. Also shown for comparison is the estimated input sensitivity for the OHC with the attenuation by the helicotrema excluded. CM sensitivity curves both have lower slopes than their predicted functions, but the change caused by helicotrema occlusion is comparable.

Wind Turbines are Hazardous to Human Health

Alec N. Salt, Ph.D., Cochlear Fluids Research Laboratory, Washington University in St. Louis.

Overview of The Problem:

Wind turbines such as those currently being constructed in rural areas **generate high levels of infrasound noise.** This is very low frequency noise (sound waves of less than 20 cycles per second) that **you cannot hear. Even though you cannot hear the sound, it is easily detected by the ear at the levels that are produced and can have effects on the body that profoundly disturb some individuals.**

The situation is somewhat similar to **ultraviolet (UV) light and the eye.** We cannot see ultraviolet light but we all understand that it can affect us profoundly, causing sunburn, photokeratitis (also known as snow blindness or welder's flash) and cataracts. For UV light, there are simple ways that the damaging effects can be avoided using sunscreens and eye protection.

For infrasound exposure in your home, there is currently **NO WAY TO PROTECT YOURSELF.** Although double glazing and door seals will reduce the levels of the sounds you can hear, they have little influence on the infrasound level in the home. Infrasound is a slowly-changing pressure wave, that can only be blocked by completely sealing the house, making it airtight. In practice this cannot be performed due to building codes and the risk of suffocation.

The effects of wind turbine infrasound build up slowly on people. For most, there are no effects while in the vicinity of wind turbines for short periods (such as the workday) and when higher levels of other sounds (i.e. sound you can hear) are present. **The problem arises when people try and sleep in their homes in the presence of wind turbine noise.** The audible sounds are reduced by the house structure, so the room may be fairly quiet, but the sound becomes dominated by the infrasound that the person cannot hear. The infrasound is detected by the ear and has subtle influences on the body that we are only just beginning to understand. It can cause dysequilibrium (like sea-sickness, but not induced by movement), tinnitus, a sensation of fullness in the ear and worst of all, disturb sleep, **probably** by stimulation of subconscious neural pathways to the brain. People undergo repeated arousals from sleep (brief partial awakenings that are not remembered) and repeated awakenings when sleeping in such an environment that leave the individual stressed and unrefreshed. Sleep disturbance over a prolonged period is known to be extremely hazardous to health, causing mental changes, high blood pressure, diabetes and increased mortality.

In many cases, these health effects have been significant enough to force people to abandon their homes. In a few cases the homes have been "bought out" by the wind turbine companies (and the owners typically "silenced" by non-disclosure agreements, otherwise known as "gag" orders), but in others the home is abandoned and is difficult to sell to another family. Properties located in the vicinity of wind turbines are becoming increasingly difficult to sell. Recent epidemiological studies suggest that significant disturbances of sleep and mental health occur for people living in homes up to 5 kilometers away from the wind turbines. This is because infrasound is capable of traveling greater distances than the sound you normally hear (which is why elephants and whales use it to communicate).

The wind turbine companies and most politicians are **turning a deaf ear to this problem,** and continue to promulgate false and debunked arguments that no problem exists. In this collection of pages we consider in detail some of these issues in which we have scientific expertise.

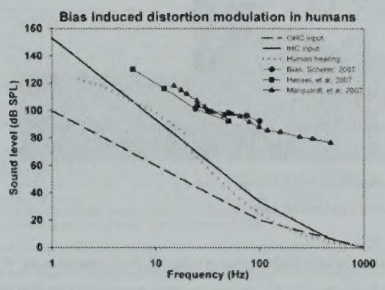


Figure 5.

Frequency dependence of low frequency bias induced modulation of the $2f_1$-f_2 distortion product measured in the external ear canal of humans in three studies, compared with estimated input functions and human hearing sensitivity. Below 100 Hz the sensitivity to bias falls off at a much lower slope than human hearing, consistent with the response originating from OHC with a lower cutoff slope.

National Wind Watch

November 7, 2010
Health, Noise

Infrasound: Your ears "hear" it but they don't tell your brain

Salt, Alec

Presentation by Alec N. Salt, PhD, Department of Otolaryngology, Washington University School of Medicine, St. Louis, Missouri, USA, at the Symposium on Adverse Health Effects of Industrial Wind Turbines, Picton, Ontario, October 29-31, 2010.

[Download a PDF of the presentation slides from the link at end of this article.]

Wind turbines generate infrasound.
Wind turbine infrasound is at levels that cannot be heard.

Widely cited interpretations:

- "If you cannot hear a sound ··· it does not affect you." — Leventhall G. What is infrasound? *Progress in Biophysics and Molecular Biology* 2007; 93:130-137
- "Infrasound is negligible" — DEFRA. *Low Frequency Noise from Large Wind Turbines* 2008
- "Infrasound ··· is below the audible threshold and of no consequence" — Leventhall G. *Canadian Acoustics* 2006; 34:29-36.

This logic seems to be applied only to hearing. Consider other senses:

- Taste: If you can't taste it, it can't affect you? Can you taste salmonella?
- Smell: If you can't smell it, it can't affect you? Try breathing pure CO or CO_2.
- Sight: If you can't see it, it can't affect you? Photokeratitis, "snow blindness", "welder's flash", cataracts, sunburn: Ultraviolet (UV) light is invisible; even though you can't see it, UV *does* affect you. UV can harm you.

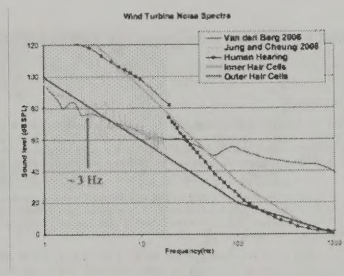
"If you can't hear it, it can't affect you" is only true:
If no other part of the ear is more sensitive than hearing, and
If no other part of the body is more sensitive than hearing ···
and I will show this is *not* true.

Infrasound at moderate levels is detected by the ear.
Infrasound at levels generated by turbines affect the ear.

Vibrations cause a bending of the ear's sensory hairs. The inner hair cells are connected to auditory type I nerve fibers that send signals to the brain. You "hear" with your inner hair cells.

Inner (IHC) and outer (OHC) hair cells respond differently as sound frequency is changed. IHC respond to velocity. OHC respond to displacement. OHC respond at ~40 dB below IHC sensitivity at 2 Hz.

Outer hair cells will be stimulated by wind turbine noise.



Outer hair cells do not just detect sound:
For low-amplitude high frequencies, OHC elongate when hairs are bent outwards, which makes stimulus greater for IHC (amplifies signal).
Amplifier becomes less effective (less necessary) for higher level sounds, ineffective about 40 dB above threshold.
(Reichenbach T, Hudspeth AJ. *Proc Natl Acad Sci U S A* 2010)
High-Frequency stimulus: OHC elongate; Vibration amplitude at the IHC is amplified.
At very low frequencies, we know that bending the hairs laterally causes OHC to contract.
Infrasound stimulus: OHC contract; Vibration amplitude at the IHC is reduced.
OHC are detecting low-level infrasound and actively canceling it for the IHC.

Physiologic pathway exists for infrasound at levels that are not heard to affect the brain.
The idea that infrasound effects can be dismissed because they are inaudible is *incorrect.*
Infrasound => OHC => (via type II nerve fibers) subconscious brain: ear fullness, ear pressure, discomfort, alerting/sleep disturbance

A-weighting corrects a sound measurement to represent what is *heard*, based on the human audibility (40 phon) curve. At 1 Hz, −148 dB correction, equivalent to dividing by 25 million.

Effect of A-weighting wind turbine noise: Massive (140 dB) de-emphasis of infrasound component. A-weighting may represent what you hear – but hearing does not give a reliable indication of whether the infrasound is affecting your ears.

"A-weighting" principle applied to UV light is equivalent to adjusting sunlight spectrum for what is visible and then saying: "There is nothing here that can harm you. You don't need sunscreen. You don't need sunglasses. Go spend all day laying out in the sun." This approach isn't rational when applied to light, so why do we accept similar logic applied to sound?

Measuring visible light (e.g., photographs) tells you NOTHING about UV content. Similarly, A-weighted measurements tell you NOTHING about infrasound content.

A-weighted spectra totally misrepresent the effects of wind turbine noise (that includes infrasound components) on the ear.
A-weighted level readings (e.g., 42 dBA) are totally meaningless for assessing whether turbine noise is affecting the ear.

Documenting Wind Turbine Sound
• Most video cameras do not record the infrasound component of wind turbine noise.
• Speaker systems in TVs and computers cannot play back the infrasound component.
• Even if they did – you can't hear it!
• Video recordings of wind turbines give no indication of the infrasound level being produced.
• Infrasound can only be measured with specialized instrumentation capable of detecting sounds down to ~1 Hz.

G-weighting weights infrasound components (excluding higher frequencies) according to human sensitivity curve.

G-weighted turbine measurements: For most of these conditions, the ear will be stimulated by the turbine noise. Jakobsen J. Infrasound emission from wind turbines. *Journal of Low Frequency Noise Vibration and Active Control* 2005; 24:145–155.

Other ways that infrasound could affect the ear:

Stimulation of vestibular hair cells (saccule, utricle).

- Vestibular hair cells are "tuned" to infrasonic frequencies.
- No-one has ever measured sensitivity to acoustic infrasound.
- Symptoms: unsteadiness, queasiness

Disturbance of inner ear fluids (e.g. endolymph volume).

- Low-frequency sound at non-damaging levels induces endolymphatic hydrops (a swelling of one of the fluid spaces).
- Infrasound does affect endolymph volume – it is the basis of a treatment for hydrops (Meniere's disease).
- No one has ever measured what level of infrasound causes hydrops.
- Symptoms: ear fullness, unsteadiness, tinnitus

Infrasound – affected structures and long-term exposure effects, ranked by sensitivity:

1. Outer hair cells — "Overworked, tired, irritated" OHC, type II fiber stimulation
2. Inner ear fluid homeostasis — Volume disturbance, endolymphatic hydrops
3. Saccular hair cells — Stimulation
4. Other, non-ear, receptors — Stimulation
5. Inner hair cells/hearing — None

Sensitivity and sensations remain to be quantified: ear pressure or fullness, discomfort, arousal from sleep; ear fullness, tinnitus, unsteadiness; unsteadiness, stress, anxiety.

"Wind Turbine Syndrome" — You cannot hear what causes the symptoms!

We need more research to define the sensitivity of these processes.

Sounds you cannot hear ...
Can affect you.
Can disturb you.
Can harm you.
Can cause disease: auditory and balance disorders, effects of sleep deprivation are serious (hypertension, diabetes, mortality).

Conclusion and Recommendations
For years, people have been told that infrasound you cannot hear cannot affect you. This is completely wrong.

Because the inner *ear does* respond to infrasound at levels that are not heard, people living near wind turbines are being put at risk by infrasound effects on the body that no one presently understands.

Until a scientific understanding of this issue is established we should not be dismissing these effects, but need to be erring on the side of caution.

For industrial turbines a cautious approach could require -

1. Setbacks of at least 2 kilometers (~1.24 miles).
2. In-home monitoring of both A-weighted (audible) and G-weighted (infrasound) noise levels 24 hours/day for all dwellings within 2 miles.
3. Health monitoring studies for those living within 2 miles (with consent).

Finally ...
We need to stop ignoring the infrasound component of wind turbine noise and find out why it bothers people!

Wind turbine noise is *not* comparable to the rustling of leaves.

Download original document: "Infrasound: Your ears 'hear' it but they don't tell your brain" [1]

URLs in this post:
[1] Download original document: "Infrasound: Your ears 'hear' it but they don't tell your brain": http://www.wind-watch.org/documents/wp-content/uploads/WTPicton_salt_final.pdf

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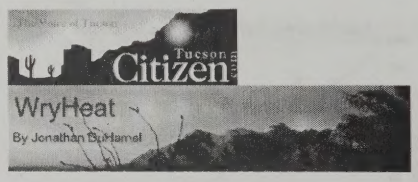

Health Hazards of Wind Turbines

by Jonathan DuHamel on Jul. 05, 2011, under Energy, Health

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The following is an article from the Doctors for Disaster Preparedness May newsletter.

> Wind farms are running into opposition from private property owners throughout the world. And it is not just a problem of blighting the view. Nor are the environmental hazards restricted to the "Cuisinart" effect on migratory birds.
>
> The most obvious problem is the noise pollution. The upper limit of allowable sound measured 100 ft in front of a locomotive is 98 dB (A), where the "A" refers to sound audible to human beings. The Vestas 1.8-MW wind turbine generates 95.6 dB (A) 10 m above the ground at the tower, at a wind speed of 4 m/s. At a wind speed >8 m/s, the sound level is 103.5 dB (A) (The Energy Advocate, November 2010).
>
> According to the British Wind Energy Association, the sound produced by a wind turbine generating electricity, outside of the nearest houses, which are at least 300 m away, is comparable to that of a flowing stream 50 m away or "leaves rustling in a gentle breeze." Yet the noise is widely reported to be more annoying than that from airplanes, roadways, and railways. This is because the sound from wind turbines has very high levels of low-frequency infrasound inaudible to the human ear, suggests Alec Salt of the Cochlear Fluids Research Laboratory at Washington University in St. Louis. The assumption that humans are unaffected by sounds they can't hear is incorrect, he states. The outer hair cells of the cochlea are stimulated by low frequency sounds at up to 40 dB below the level that is heard.
>
> Infrasound has been used in Sweden in a nonlethal weapon for riot control. The infrasound from air-conditioning systems has been implicated as a cause of sick building syndrome (S.S.). Infrasound affects the vestibular system, causing symptoms resembling seasickness, accompanied by headache, dizziness, and "deep nervous fatigue." It can affect ocular reflexes, causing nystagmus; spinal reflexes, causing tremors; and autonomic reflexes, causing shortness of breath. In the 1970s, army physiologists carried out studies on how long military personnel could perform their duties under conditions of high levels of infrasound, as in a tank, the engine room of a ship, or a space capsule, but results are secret, writes Claude, Regard of the Naval College & Military School of the Fleet (France).

The wind turbine syndrome also includes sleep problems, irritability, and depression. The variable audible noise results in frequent awakenings or arousals, which may not be remembered. The disruption of sleep prevents the proper laying down and storage of memory. It is also associated with an increased incidence of obesity, diabetes, hypertension, and heart disease. Arousals during slow wave sleep may trigger parasomnias (sleepwalking, night terrors), reports Dr. Christopher Nanning, an expert in sleep disorders.

Persons especially vulnerable to wind turbine syndrome include elderly, young children, children with developmental disabilities (especially autism spectrum disorders), and migraine sufferers.

There is also a vibroacoustic disease, which has been studied mostly in aviation workers. Different parts of the body, especially the chest and skull, have differing resonance frequencies", writes Dr. Nina Pierpont. Air pressure (sound) waves of certain wavelengths resonate within these closed spaces, setting up vibrations to which the body responds by reinforcing soft tissue with extra collagen, which could cause thickening of the pericardium and cardiac valves, fibrosis of the lungs, and proliferation of glial cells in the brain.

Because of its long wavelength, infrasound is attenuated much less than audible sound, and diffraction by obstacles such as trees and bushes is much reduced. Thus it propagates over much longer distances. It can travel over hills, and is reflected by temperature inversion zones. This explains why the explosion of Mount St. Helens was felt all over the world, and how elephants can communicate with each other over tens of kilometers thanks to the temperature inversion zone that forms between sunset and sunrise.

Still another problem is shadow flicker, or a strobe effect. Some people lose their balance or experience symptoms of seasickness. Like other flashing lights, the strobe effect can trigger seizures in persons with epilepsy.

Some people are so severely affected that they abandon their homes. In Germany, real estate agents report a 20% to 30% loss of value for property within sight of wind farms. In some places in the U.S., wind turbines may render nearby property unsalable. A study of the proposed Cape Wind project in Massachusetts concluded that the total property value loss of about $1.35 billion would exceed the $800 million cost of construction.

Animals may be even more severely affected by the sound from turbines, especially the low-frequency sounds. The animal kingdom relies upon a wide range of sound frequencies inaudible to humans. Basic survival functions including hunting, self-protection, and reproduction are impaired, and habitat may be abandoned. The irreversible destruction of habitat may be even more serious than collision mortality for birds. Livestock miscarriages are destroyed: hens stop laying; cattle exhibit aggressive, destructive behavior; sheep have disturbed respiration and reduced feeding. In Taiwan, 400 goats died after eight wind turbines were installed nearby, apparently because they couldn't sleep.

Although the wind industry has often stated that "there is no peer-reviewed scientific evidence indicating wind turbines have an adverse effect on human health," the evidence is indeed accumulating. John Droz, Jr., notes that North Carolina mandates no human health review for a wind project, though the impact on birds is reviewed. He provides a wealth of information at www.WindPowerFacts.info.

The "dirty" electricity produced by the turbines may also be harmful. The output from the inverters is contaminated with a lot high-frequency transients, which cause "radio wave sickness" symptoms that disappear on leaving the area. Radio, TV, and satellite dish reception is also impaired (Canada Free Press 4/28/09).

Wind energy has substantially raised the cost of electricity everywhere it is installed. The goal, of course, is to reduce CO2 emissions. But as even the Green Party has recognized, 20,000 turbines in Germany, the world's leader in total wind energy capacity, have reduced CO2 by not a single gram (Der Spiegel 2/1 1/09). In fact, because of the inefficient use of gas turbines as spinning reserves to cope with the variability of wind-power output, emissions may actually increase (D. White, Renewable Energy Foundation, December 2004). The largest theoretical reduction in CO2 emissions from wind, compared with coal or gas, is 10%, since traditional power stations with 90% of the total capacity of wind must be online at all times to assure continuous power- (Inhaber H, Renewabre Sustainable Energy Rev 2011;15:2557256?).

Turbulence from wind turbines, causing vertical mixing of heat in atmospheric layers, might even affect local temperatures and rainfall (Nature 12/23-30/10).

World investment in "clean" energy was $243 billion in 2010, a 630% growth in finance and investments since 2004, according to the Pew Environmental Group (TWTW 6/25/11). The U.S. is winning the wind race with China, having installed 8.5 GWe (nameplate) of wind capacity in 2008, versus 4.7 GWe for China. But China is not running that race; it is, instead, installing affordable, dependable energy for the prosperity of its citizens (TWTW 1/20/10, www.sepp.org). Wind and solar are export industries for China, and they are suffering "because the Europeans are running out of mad money," writes Norman Rogers.

If the CO2 emissions reduction game doubles the cost of electricity in the U.S., the extra $300 billion is half the cost of Medicare in 2008. It would be a big savings, Rogers suggests, for the government to bribe people to stop building windmills (Amer Thinker5/1/11). But it's all about political power—not human health.

More on wind turbine's effect on wildlife:

Windmills are killing our birds

Wind Turbines Sprayed While Bats Take Beating

Bats, Birds, and Blades

See also:

Electricity generated by wind power may raise temperatures and costs

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This entry was posted on Tuesday, July 5th, 2011 at 8:55 am and is filed under Energy, Health. Tags for this post: bird deaths, doctors for disaster preparedness, health hazards, wind turbines. You can follow any responses to this entry through the RSS 2.0 feed. You can leave a response, or trackback from your own site.

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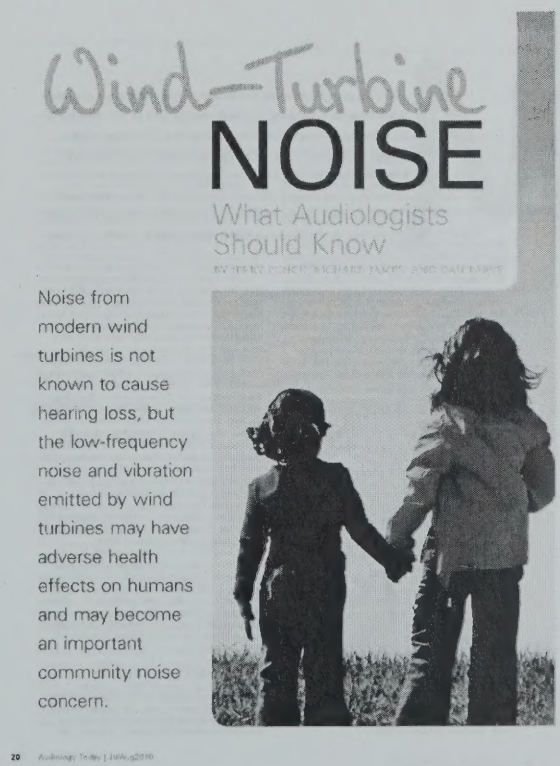
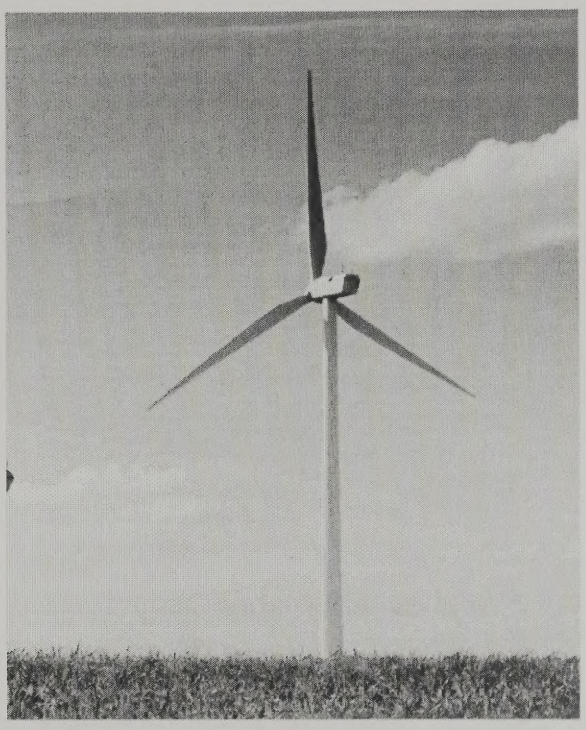




completely automatic controls that monitor and regulate operations and safety. Wind speed can be much greater at hub level than at ground level, so taller wind towers are used to take advantage of these higher wind speeds. Calculators are available for predicting wind speed at hub height, based on wind speeds at 10 meter weather towers, which can easily be measured directly.

Mechanical equipment inside the nacelle generates some noise, but at quieter levels than older turbines. This mechanical sound is usually considered of secondary importance in discussions of annoyance from today's turbines. The main cause of annoyance is an aerodynamic source created by interaction of the turning blades with the wind. With optimal wind conditions, this aerodynamic noise is steady and commonly described as an airplane overhead that never leaves.

When wind conditions are not optimal, such as during turbulence caused by a storm, the steady sounds are augmented by fluctuating aerodynamic sounds. Under windy wind conditions, this interaction generates a fee-fahnand whooshing sound that repeats itself about once a second and is clearly audible. Many people who live near the wind turbine yard dust condition to be very disturbing.

The whooshing sound comes from variations of air turbulence from hub to blade tip and the inability of the turbine to keep the blades adjusted at an optimal angle as wind direction varies. The audible portion of the whoosh is around 500 Hz, which can easily penetrate walls of homes and other buildings. In addition, the rotating blades create energy at frequencies as low as 1–2 Hz (the blade passage frequency, with overtones of up to about 20 Hz. Although some of this low-frequency energy is audible to some people with sensitive hearing, the energy is mostly vibratory to people who react negatively to it.

Adverse Health Effects of Wind-Turbine Noise

Hubbard and Shepherd (1990), in a technical paper written for the National Aeronautics and Space Administration (NASA), were the first to report in depth on the noise and vibration from wind turbines. Most of the relevant research since that time has been conducted by European investigators, as commercial grade utility-scale wind turbines have existed in Europe for many decades. Unfortunately, the research and development done by wind turbine manufacturers is proprietary and typically has not been shared with the public, but reports of the distressing effects on people living near utility-scale wind turbines in various parts of the world are becoming more common.

Studies carried out in Denmark, The Netherlands, and Germany (Pedersen and Waye, 2004; Pedersen et al., 2008; Pedersen and Persson Waye, 2007; Pedersen and Larman, 2008; Pedersen et al., 2009; Verheijen et al., 2009) and two Swedish studies (Pedersen and Persson Waye, 2004; Pedersen and Persson Waye, 2007) collectively indicate that wind turbines differ from other sources of community noise in several respects. These investigators confirm the findings of earlier research that amplitude-modulated sound is more easily perceived and more annoying than constant level sounds (Bradley, 1994; Arnoldussen et al., 2008) and that sounds that are unpredictable and uncontrollable are more annoying than other sounds (Green and McGowan, 1984; Hatfield et al., 2002).

Annoyance from wind turbine noise has been difficult to characterize by the use of such psychoacoustic parameters as sharpness, loudness, roughness, or modulation (Persson Waye and Öhrström, 2002). The inaudible low-frequency nature of wind-turbine noise, in combination with the fluctuating blade sounds, also means that the noise is not easily masked by other environmental sounds.

Pedersen et al. (2008), in a survey conducted in The Netherlands on 725 respondents, found that noise from

Most of us would agree that the modern wind turbine is a desirable alternative for producing electrical energy. One of the most highly touted ways to meet a federal mandate that 20 percent of all energy must come from renewable sources by 2020 is to install large numbers of utility-scale wind turbines. Evidence has been mounting over the past decade, however, that these utility-scale wind turbines produce significant levels of low-frequency noise and vibration that can be highly disturbing to nearby residents.

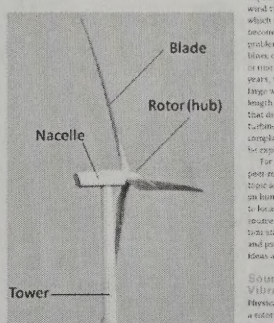
Noise of these unwanted emissions, whether audible or inaudible, are believed to cause hearing loss, but they are widely known to cause/elicit disturbances. Inaudible components can induce resonant vibration in solids, liquids, and gases—including the ground, houses, and other building structures, spaces within those structures, and bodily tissues and cavities—that is potentially harmful to humans. The most extreme of these low-frequency (infrasonic) emissions, at frequencies under about 16 Hz, can easily penetrate homes. Some residents perceive the energy as sound, others experience it as vibration, and others are not aware of it at all. Research is beginning to show that, in addition to sleep disturbances, these emissions have other deleterious consequences on health. It is for these reasons that wind turbines are becoming an important community health issue, especially when hosted in quiet rural communities that have no prior experience with industrial noise or urban hum.

The people most susceptible to disturbances caused by wind turbines may be a small percentage of the total exposed population, but for them the introduction of wind turbines in their communities is not something to which they can easily become accustomed. Instead, they become annoyed, uncomfortable, distressed, or ill. This problem is increasing as newer utility-scale wind turbines, capable of generating 1.5–5 MWatts of electricity (or more) replace the older turbines used over the past 30 years, which produced less than 1 MWatt of power. These large wind turbines can have hub heights that span the length of a football field and blade lengths that span half that distance. The increased size of these multi-MWatt turbines, especially the blades, has been associated with complaints of adverse health effects (AHEs) that cannot be explained by auditory responses alone.

For this article, we reviewed the English-language, peer-reviewed literature from around the world on the topic of wind turbine noise and vibration and their effects on humans. In addition, we used popular search engines to locate relevant online trade journals, books, reference resources, governmental regulations, and acoustic and vibration standards. We also consulted professional engineers and psychoacoustic/hearing researchers regarding their unpublished ideas and research.

Sources of Wind-Turbine Noise and Vibration

Physically, a modern wind turbine consists of a tower; a rotor (or hub), a set of rotating blades—usually three, located upwind to the tower; and a nacelle, which is an enclosure containing a gearbox, a generator, and



Major components of a modern wind turbine.

wind turbines is more annoying than transportation or industrial noises at comparable levels, measured in dBA. They noted that annoyance from turbine sounds at 35 dBA corresponds to the annoyance reported for other common community noise sources at 45 dBA. Higher visibility of the turbines was associated with higher levels of annoyance, and annoyance was greater when attitudes toward the visual impact of the turbines on the landscape were negative. However, the height of wind turbines means that they are also most clearly visible to the people closest to them and those who also receive the highest sound levels. Thus, proximity of the receiver to wind turbines makes it difficult to determine whether annoyance to the noise is independent of annoyance to the visual impact. Pedersen et al. (2009) also found that annoyance was substantially lower in people who considered economically from having wind turbines located on their property.

Among audiologists and acousticians, it has been understood for many decades that sufficiently intense and prolonged exposure to environmental noise can cause hearing impairment, annoyance, or both. In essence, the more loss noise that you can hear, can hurt you. In the case of wind turbines, it seems that what you can't hear can also hurt you. Again, there is no evidence that noise generated by wind turbines, even the largest utility-scale turbines, causes hearing loss. But there is increasingly clear evidence that audible and low-frequency acoustic energy from these turbines is sufficiently intense to cause extreme annoyance and inability to sleep, or disturbed sleep, in individuals living near them.

Jung and colleagues (2008), in a Korean study, concluded that low-frequency noise in the frequency range above 90 Hz can lead to psychological complaints and that infrasound in the frequency range of 5–8 Hz can cause complaints due to rattling doors and windows in homes.

The energy generated by large wind turbines can be capable disturbing to the vestibular systems in some people, as well as cause other troubling sensations of the head, chest, or other parts of the body. Dr. Nina Pierpont (2009), in her definitive natural experiment on the subject, refers to these effects as Wind-Turbine Syndrome (WTS). I insist the symptoms that, in various combinations, characterize WTS. Although hearing impairment is not one of the symptoms of WTS, audiologists who see patients report these symptoms should ask them if they live near a wind turbine.

It is well known that sleep deprivation has serious consequences, and we know that some continuous sounds and nighttime sounds are less tolerable than continuous and daytime sounds. Somewhat related effects, such as cardiac arrhythmias, stress, hypertension, and headaches have also been attributed to noise or vibration from wind turbines, and some researchers are referring to these effects as Vibroacoustic Disease, or VAD (Castelo Branco, 1999; Castelo Branco and Alves-Pereira, 2004). VAD is described as occurring in persons who are exposed to high level (>60 dB SPL) infra- and low-frequency noise (ILFN), under 500 Hz, for periods of 10 years or more. It is believed to be a systemic pathology characterized by direct tissue damage to a variety of bodily organs and may involve abnormal proliferation of extracellular matrices.

Alves-Pereira and Castelo Branco (2007) reported on a family who lived near wind turbines and showed signs of VAD. The sound levels in the home were less than 60 dB SPL in each 1/3-octave band below 100 Hz. We have recorded unweighted sound levels ranging from 60 to 70 dB low level aged over 1 minute) in those low frequency bands in Ontario homes of people reporting AHEs from wind turbines. A spectral analysis of sounds emitted at a Michigan site revealed that unweighted peak levels at frequencies under 5 Hz exceeded 80 dB SPL (Wade Bray, pers. comm., 2009).

Table 1. Core Symptoms of Wind-Turbine Syndrome

✓	Sleep disturbance
✓	Headache
✓	Visceral Vibratory Vestibular Disturbance (VVVD)
✓	Dizziness, vertigo, lightheadedness
✓	Tinnitus
✓	Ear pressure or pain
✓	External auditory canal sensation
✓	Memory and concentration defects
✓	Irritability, anger
✓	Fatigue, loss of motivation

Source: Pierpont, 2009.

Similar observations have been made in studies of people who live near busy highways and airports, which also expose people to low-frequency sounds, both outdoors and in their homes. Evidence is insufficient to substantiate that typical exposures to wind-turbine noise, even in residents who live nearby, can lead to VAD, but early indications are that those are some more vulnerable people who may be susceptible. Because ILFN is not yet recognized as a disease agent, it is not covered by legislation, permissible exposure levels have not yet been established, and dose-response relationships are unknown (Alves-Pereira, 2007).

As distinguished from VAD, Pierpont's (2009) use of the term Wind Turbine Syndrome appears to emphasize a constellation of symptoms due to vibroacoustic stimulation of the vestibular organs of balance. The ILFN from wind turbines (see Table 1), one of the most distinctive symptoms she lists in the constellation of symptoms comprising WTS is Vestibular Oculomotor Disturbance (VOMD), which she defines as "a sensation of internal quivering, vibration, or pulsation accompanied by agitation, anxiety, alarm, irritability, rapid heartbeat, tinnitus, and sleep disturbance" (p. 270).

Drawing on the recent work of Balaban and colleagues (see Balaban and Yates, 2004), Pierpont describes the close association between the vestibular system and its central connections to brain nuclei involved with balance processing, autonomic and somatic sensory inputs and outflow, the fear and anxiety associated with vertigo or a sudden feeling of postural instability, and aversive learning. These neurological relationships give credence to Pierpont's linkage of the symptoms of VWVD to the vestibular system.

Todd et al (2008) demonstrated that the resonant frequency of the human vestibular system is 100 Hz, concluding that the mechano-receptive hair cells of the vestibular structures of the inner ear are remarkably sensitive to low-frequency vibration and that this sensitivity to vibration exceeds that of the cochlea. Not only is 100 Hz the frequency at the peak response of the vestibular system to vibration, but it is also a frequency at which a substantial amount of acoustic energy is produced by wind turbines. Symptoms of both VAD and VWVD can presumably occur in the presence of ILFN as a result of disruptions of normal paths or structures that mediate the fine coordination between living tissue deformation and activation of signal transducers; these disruptions can lead to aberrant mechano-electrical coupling that can, in turn, lead to conditions such as heart arrhythmias (Ingber, 2008). Additionally, further research will be needed to sort out the commonalities and differences among the symptoms variously described in the literature as VAD, VWVD, and WTS.

Dr. Geoff Leventhall, a British scientist, and his colleagues (Moye et al., 1997; Leventhall, 2003, 2004) have documented the detrimental effects of low-frequency noise exposure. They consider it to be a special environmental noise, particularly to sensitive people in their homes. Moye et al. (1997) found that exposure to dynamically modulated low-frequency ventilation noise (20–200 Hz)—as opposed to mid-frequency noise exposure—was more bothersome, less pleasant, impacted work performance more negatively, and led to lower social orientation.

Leventhall (2003), in reviewing the literature on cochlear effects of exposure to low-frequency noise, found no evidence of hearing loss but substantial evidence of vibration of bodily structures (chest vibration), annoyance (especially in homes), perceptions of unpleasantness/pressure on the eardrum, unpleasant perception within the chest area, and a general feeling of ill-being, sleep disturbance (reduced waked-from), stress, reduced performance on demanding

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sound-level readings in the lower frequencies, beginning at 1000 Hz, and reduced sounds at 20 Hz by 50 dB.

For wind-turbine noise, the A-weighting scale is especially ill suited because of its description of the effects of low-frequency noise. This is why it is important to utilize C-weighted measurements, as well as A-weighted measurements, when considering the impact of sound from wind turbines. Theoretically, linear-scale measurements would seem superior to C-scale measurements in wind-turbine applications, but linear-scale measurements lack standardization due to failure on the part of manufacturers of sound-level meters to agree on such factors as low-frequency cutoff and response-tolerance limits. The Z-scale, or zero-frequency weighting, was introduced in 2000 by the International Electrotechnical Commission (IEC) in its Standard 61672 to replace the flat, or linear, weighting used by manufacturers in the past.

State of Michigan Siting Guidelines

Much gain in the guidelines (9) set of Michigan, 2009) will be used as an example of guidelines that deal only in a limited way with sound. These guidelines refer to outdated, now outdated, WHO and Environmental Protection Agency (EPA) guidelines to support a noise criterion that SPLs cannot exceed 55 dBA at the nearest property line. This level is allowed to be exceeded during severe weather or power outages, and when the ambient sound level is greater than 55 dBA, the turbine noise can exceed

that higher background sound level by 5 dB. These levels are about 10 dB above the nighttime levels of most rural communities. When utility-scale turbines were installed in Huron County, Michigan, in May 2008, the WHO's (1999) guidelines that call for nighttime outside levels not to exceed 30 dBA were allowed to stand. Based on measurements made by the authors, these turbines produce 40–45 dBA sound levels at the perimeters of a 1,000 ft radius under typical weather conditions, and the additive effects of multiple turbines produce higher levels. Many of the turbines have been located close enough to homes to produce very noticeable noise and vibration.

Kamperman and James (2008) have offered recommendations for change in the State of Michigan guidelines (2008) for wind turbines. Some of the more pertinent details of the Michigan siting guidelines are shown in the left-hand column of Table 2. The state of Michigan permits sound levels that do not exceed 55 dBA or LOC + 5 dBA, whichever is greater, measured at the property line closest to the wind energy system. These guidelines make no provisions to limit low-frequency sounds from wind-turbine operations.

In consideration of the current WHO guidelines (2007), measurements made by the authors in Huron County, Michigan, indicate that the current Michigan guidelines do not appear adequate to protect the public from the annoyances and known health risks of wind-turbine noise. In fact, these guidelines appear to be especially lenient

Table 2. Current and Proposed Wind-Turbine Siting Guidelines

Current Michigan Guidelines*	Kamperman Proposed Guidelines†
Sound level cannot exceed 55 dBA or L90 + 5 dBA, whichever is greater.	Operating LAeq is not to exceed the background LA90 +5 dBA, where LA90 is measured during a preconstruction noise study at the quietest time of night. Similar dBC limits should also be applied.
Limits apply to sound levels measured at homes, as stated in Huron County Ordinance.	Limits apply to sound levels measured at property lines, except that turbine sounds cannot exceed 35 dBA at any home.
No provisions are made for limiting low-frequency sounds from wind-turbine operations.	Dec: LA90 cannot exceed 20 dB at receiving property, e.g., Dec from turbines minus LA90 (background) = 5; < 20 dB, and is not to exceed 50 Dec from wind turbines (65 Dec for properties within one mile of major heavily trafficked roads)

*Source: State of Michigan, 2009
†Source: Kamperman and James, 2008

verbal tasks, and negative task-specific effects that included quantitative measurements of EEG activity, blood pressure, respiration, hormone production, and heart rate.

Regarding work performance, reviewed at slides indicated that dynamically modulated low-frequency noise, even when inaudible to most individuals, is more difficult to ignore than mid- or high-frequency noise and that the hypervigilance to habituation leads to reduced available information-processing resources. Leventhall hypothesized that low-frequency noise, therefore, may impede work performance. More recently, as a consultant on behalf of the Kenetech Wind Energy Association (KWEA), the American Wind Energy Association (AWEA), and the Canadian Wind Energy Association (CANWEA), Leventhall (2006) changed his position, stating that although wind turbines do produce significant levels of low-frequency sound, they do not pose a threat to humans—in effect reverting to the notion that what you can't hear can't hurt you.

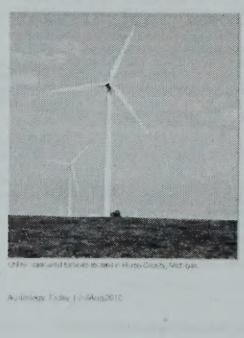
According to the World Health Organization guidelines (WHO, 2007), annoyable effects of nighttime, outdoor wind-turbine noise do not occur at levels of 30 dBA or lower. Many rural communities have ambient, nighttime sound levels that do not exceed 25 dBA. As outdoor sound levels increase, the risk of ARDs also increases, with the most vulnerable being the first to show its effects. Vulnerable populations include elderly persons, children, especially those younger than age six; and people with pre-existing medical conditions, especially if sleep is affected. For outdoor sound levels of 40 dBA or higher, the WHO states that there is sufficient evidence to link prolonged exposure to ARDs. While the WHO identifies long-term, nighttime audible sounds over 30 dBA outside one's home as a cause of ARDs, the wind industry commonly promotes 50 dBA as a safe limit for nearby homes and properties. Recently, a limit of 45 dBA has been proposed for new wind projects in Canada (Keith et al., 2008).

Much of the answer as to why the wind industry denies that noise is a serious problem with its wind turbines is because holding the noise to 50 dBA at night has serious economic consequences. The following quotation by Upton Sinclair seems relevant here: "It is difficult to get a man to understand something when his salary depends upon his not understanding it" (Sinclair, 1935, reprinted 2003, p. 109).

In recent years, the wind industry has denied the validity of any noise complaints by people who live near its utility-scale wind turbines. Residents who are leasing their properties for the siting of turbines are generally so pleased to receive the lease payments that they seldom complain. In fact, they normally are required to sign a leasing agreement, or gag clause, stating they will not speak or write anything unfavorable about the turbines. Consequently, complaints, and sometimes lawsuits, tend to be initiated by neighbors who live near property on which wind turbines are sited, and not by those who are leasing their own property. This situation sets neighbor against neighbor, which leads to antagonistic divisions within communities.

Measurement of Wind-Turbine Noise

It is important to point out that the continued use of the A-weighting scale in sound-level meters is the cause for misunderstandings that have led to acrimony between advocates and opponents of locating wind turbines in residential areas. The dBA scale grew out of the desire to incorporate a function into the measurement of sound pressure levels of environmental and industrial noise that is the inverse of the minimum audibility curve (Fletcher and Munson, 1933) at the 40-phon level. It is typically used, though, to specify the levels of noises that are more intense, where the audibility curve becomes considerably flattened, elevating the need for A-weighting. It is mandated in various national and international standards for measurements that are supposed to damage-risk criteria for hearing loss and other health effects. The A-weighted scale on sound-level meters drastically reduces



Utility-scale wind turbines in rural Huron County, Michigan.

its forms of tolerable sound levels. Sound levels that approach 20 dBA higher than natural ambient levels are considered intolerable in most countries. Michigan permits 40 dBA increases.

In considering the health and well-being of people living near wind-turbine projects, the change recommended by Kamperman and James (2008) would abandon the 55 dBA limit in favor of the community-accepted criteria of LA90 + 5 dBA, for both A- and C-scale readings, where LA90 is the preconstruction ambient level. These recommendations also include a prohibition against any wind turbine-related sound levels exceeding 35 dBA on receiving properties that include homes or other structures in which people sleep. Additional protections against low-frequency sound are given in the right-hand column of Table 2. These recommended provisions would protect residents by limiting the difference between C-weighted

People living near wind turbines may experience sleep disturbance.

Leq during turbine operation and the quietest A-weighted pre-operation background sound levels, plus 5 dB, to no more than 40 dBA at the property line. This level should not exceed 55 dB Leq on the C scale, or 60 dB Leq for properties within one mile of major heavily trafficked roads, which sets a higher tolerance for communities that tend to experience slightly noisier conditions.

Implementation of the recommendations of Kamperman and James would result in siting wind turbines differently than what is currently planned for future wind-turbine projects in Michigan. This change would result in sound levels at nearby properties that are much less noticeable, and much less likely to cause sleep deprivation, annoyance, and related health risks. These sound-level measurements should be made by independent acoustical engineers or knowledgeable audiologists who follow ANSI guidelines (1996, 1994) to ensure fair and accurate readings and not by representatives of the wind industry.

People living within a mile (1.6 km) or more wind turbines, and especially those living within a half mile, have frequent sleep disturbance leading to sleep deprivation, and sleep disturbances are common in people who live up to about 1.35 miles away. This is the setback distance at which a group of turbines would need to be in order not to be a nighttime noise disturbance (Kamperman and James, 2008). It is also the setback distance used in several other countries that have substantial experience with wind turbines, and as the distance at which Pierpont (2009) found very few people reporting ARDs.

A study conducted by van den Berg (2008) in The Netherlands demonstrated that daytime levels cannot be used to predict nighttime levels and that residents within 1,900 mile (3.18 mile) of a wind-turbine project expressed annoyance from the noise. Pierpont (2009) recommends baseline minimum setbacks of 2 kilometers (1.24 miles) from residences and other buildings such as hospitals, schools, and nursing homes, and longer setbacks in mountainous terrain and when necessary to meet the noise criteria developed by Kamperman and James (2008).

In a panel review report, the American Wind Energy Association (AWEA) and Canadian Wind Energy Association (CANWEA) have objected to setbacks that exceed 1 mile (Colby et al, 2009). A coalition of independent medical and acoustical experts, the Society for Wind Vigilance (2010), has provided a recent rebuttal to that report. The society has described the panel review as a typical product of industry-funded white papers, being neither authoritative nor convincing. The society accepts as a verified fact that sleep disturbance, physiological stress, and psychological distress can result from exposure to wind-turbine noise.

Wind turbines have different effects on different people. Some of these effects are somewhat predictable based on financial compensation, legal restrictions on free speech included in the lease contracts with hosting landowners, and distance of the residence from wind projects, but there are sometimes totally unpredictable. Planning for wind projects needs to be directed not only toward benefitting society at large but also toward protecting the individuals living near them. We believe that the state of Michigan, and other states that have adopted similar siting guidelines for wind turbines, are not acting in the best interests of all their citizens and need to revise their siting guidelines to protect the public from potential health risks and loss of property values, as well as reduce complaints about noise annoyance.

Wind-energy developers proposing new projects for a potential host community are often asked if their projects will cause the same negative community responses that are heard from people living in the footprint of operating projects. They often respond that there will not a different

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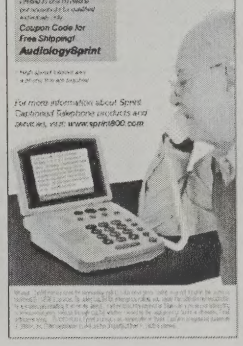

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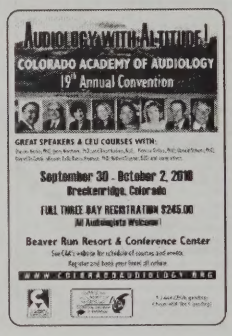

National Wind Watch

July 8, 2010
Health, Noise, Technology

Wind-turbine noise: What audiologists should know

Punch, Jerry; James, Richard; and Pabst, Dan

Most of us would agree that the modern wind turbine is a desirable alternative for producing electrical energy, one of the most highly touted ways to meet a federal mandate that 20 percent of all energy must come from renewable sources by 2020 is to install large numbers of utility-scale wind turbines. Evidence has been mounting over the past decade, however, that these utility-scale wind turbines produce significant levels of low-frequency noise and vibration that can be highly disturbing to nearby residents.

None of these unwanted emissions, whether audible or inaudible, are believed to cause hearing loss, but they are widely known to cause sleep disturbances. Inaudible components can induce resonant vibration in solids, liquids, and gases—including the ground, houses, and other building structures, spaces within those structures, and bodily tissues and cavities—that is potentially harmful to humans. The most extreme of these low-frequency (infrasonic) emissions, at frequencies under about 16 Hz, can easily penetrate homes. Some residents perceive the energy as sound; others experience it as vibration, and others are not aware of it at all. Research is beginning to show that, in addition to sleep disturbances, these emissions may have other deleterious consequences on health. It is for these reasons that wind turbines are becoming an important community health issue, especially when located in quiet rural communities that have no prior experience with industrial noise or urban hum.

The people most susceptible to disturbances caused by wind turbines may be a small percentage of the total exposed population, but for them the introduction of wind turbines in their communities is not something to which they can easily become acclimated. Instead, they become annoyed, uncomfortable, distressed, or ill. This problem is increasing as newer utility-scale wind turbines capable of generating 1.5–5 MWatts of electricity or more replace the older turbines used over the past 20 years, which produced less than 1 MWatt of power. These large wind turbines can have hub heights that span the length of a football field and blade lengths that span half that distance. The increased size of these multi-MWatt turbines, especially the blades, has been associated with complaints of adverse health effects that cannot be explained by auditory responses alone.

For this article, we reviewed the English-language, peer-reviewed literature from around the world on the topic of wind-turbine noise and vibration and their effects on humans. In addition, we used popular search engines to locate relevant online trade journals, books, reference sources, government regulations, and acoustic and vibration standards. We also consulted professional engineers and psychoacousticians regarding their unpublished ideas and research. ...

Audiology Today, Jul-Aug 2010

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individuals in any given communication network. Each animal has its own auditory acuity, so can hear at different distances; but for all animals, increasing background noise will reduce their natural listening area in predictable ways. The authors note analyses of transportation noise impacts often assert that a 3dB increase in noise - a barely perceptual change - has "negligible" effects, whereas in fact this increased noise reduces the listening area of animals by 30%. A 10dB increase in background noise (ed. note: likely within a few hundred meters of a road or as a private plane passes nearby) reduces listening area by 90%.

Throughout, the authors stress the difficulties in separating noise-related effects of traffic from other related forces, such as habitat fragmentation or threat responses; there is also a fascinating short section citing studies showing behavioral changes in response to quiet recreation, sometimes even more dramatic than those caused by vehicles. Though only a few studies have directly addressed this ambiguity, many studies cited here provide strong indications that acoustic masking is a significant factor in behavioral changes near roads. Among the findings that caught my eye/ear:

• Masking affects not only audibility, but understanding: "thresholds for discrimination between calls of the same species were consistently higher than were detection thresholds for the same calls." Not surprising, but easy to forget: background sound often obscures the words being said, though we can still hear the voice.

• Bats that listen for ground movements of their prey hunt more in quiet areas than noisy ones; similarly insect-eating birds are more likely to avoid noisy areas than other birds.

• Masking can also make it more difficult for animals to tell what direction a call (such as a mating call) is coming from

• Pronghorn antelope showed a marked shift in proportion of time spent foraging and in vigilance (looking around) when closer to roads: foraging dropped from 45% of the time to 35%, while vigilance increased from 40% to over 50%.

• Two key studies of increased vigilance in clearly noise-triggered contexts: Ground squirrels showed a marked increase in vigilance behavior when hearing squirrel alarm calls at a site in a wind farm than in a quiet site (including a slightly less "relaxed" non-vigilance baseline state), and a lab study with chaffinches found that the mean time spent pecking (eating) between times scanning the area decreased when noise was introduced.

The authors conclude by stressing: "Chronic noise exposure is widespread.

Taken individually, many of the papers cited here offer suggestive but inconclusive evidence that masking is substantially alter- ing many ecosystems. Taken collectively, the preponderance of evidence argues for immediate action to manage noise in protected natural areas. . The costs of noise must be understood in relation to other anthropogenic forces, to ensure effective mitigation and efficient realization of environmental goals.

Noise pollution exacerbates the problems posed by habitat fragmentation and wildlife responses to human presence; therefore, highly fragmented or heavily visited locations are priority candidates for noise management. Noise management might also offer a relatively rapid tool to improve the resilience of protected lands to some of the stresses imposed by climate change."

Web link: http://acinews.org/archives/573"

http://www.wind-watch.org/documents/wind-turbine-noise-what-audiologists-should-know-print/ 12/27/2010

NPS study: moderate noise can have major impacts on animals

An ongoing research project from the National Park Service Natural Sounds Program is about to publish a groundbreaking paper that outlines the many ways that even moderate increases in human background noise can create major impacts on animals. The study proposes a new metric for use in bioacoustics research, the "effective listening area."

December 12, 2009 in The Acoustic Ecology Institute

An ongoing research project from the National Park Service Natural Sounds Program is about to publish a groundbreaking paper that outlines the many ways that even moderate increases in human background noise can create major impacts on animals. The study proposes a new metric for use in bioacoustics research, the "effective listening area." This is the area over which animals can communicate with each other, or hear other animals' calls or movements; as might be expected, animals focus especially on listening for sounds at the very edges of audibility, so that even a small increase in background noise (from a road, wind farm, or regular passing of airplanes) can drown out sounds that need to be heard. The authors note analyses of transportation noise impacts often assert that a 3dB increase in noise - a barely perceptual change - has "negligible" effects, whereas in fact this increased noise reduces the listening area of animals by 30%. A 10dB increase in background noise (likely within a few hundred meters of a road or wind farm, or as a private plane passes nearby) reduces listening area by 90%.

In addition to introducing this important new metric, the paper provides a good overview of previous research that has addressed the impacts of moderate noise on various animals, including bats, antelope, squirrels, and birds. The paper will be published next year, though an "in press" version is available for download. A recent BBC article also covered this important new work. A full detailed lay summary of this paper, as previously published on AEI's science research page, appears below the fold:

Animal listening area and alerting distance reduced substantially by moderate human noise, Barber, Crooks, Fristrup. The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology and Evolution, 2010.

This is one of the most important and interesting papers published this year. It emerges from the partnership between the National Park Service's Natural Sounds Program and researchers at Colorado State University, who have been working together for several years to create metrics that are more useful for assessing the biological impacts of moderate human noise on wildlife. The assessments presented here, along with the paper's review of recent studies documenting changes in foraging, anti-predator behavior, reproductive success, density and community structure in response to noise, form the basis for a much more cogent assessment of noise impacts on wildlife.

The focus of this research is the ways that moderate increases in background noise can affect animals. The authors note that both air and road traffic in the US has tripled in recent decades; even in National Parks, noise is audible 25% of the time in more than half of sites assessed. Over 80% of US land area is close enough to roads for some low-frequency masking to occur, with passing trucks and motorcycles increasing the sound levels at 1km to 40dB(A).

One of the new proposed metrics is the effective "listening area." Changes in listening area has impacts involving both communication and what the authors term "adventitious" sounds (sound made largely by movement, which are important in predator/prey awareness). For predators, the listening area is the area over which they might hear the rustling of their prey, and for prey, it is the area in which they are alerted to approaching predators, whether wingbeats or footsteps; in each case, the most important sounds are those right at the edge of audibility. Social groups rely on hearing each other's alarm calls or songs inviting mating; reduced listening areas for these calls result in effectively reducing the number of

Comment Letter P344

Exhibit 39 EH Table 10 Water well information, water quality, and groundwater elevations

Ocotillo/Coyote Wells Groundwater Basin, a Sole Source Aquifer, Imperial County CA

(USG 2006 EIR/EIS Appendix B-1 USGS Hydrologic Data, USGS NWIS water level and quality data & Boekman- Edmonston 3/96 (BE96) and BE 1/2004 (BE04) cited in Coyote Wells Specific Plan 1/2010 DEIR) Not all data are shown for all wells, and not all wells monitored only once are included.

Water level measurements are fall data where possible and water quality is when monitored. Updates 2010-04, partial

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft above sea level	Static water level below ground surface ft	Groundwater elevation ft. above mean SL – AMSL	Date AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/9E-24D1 (E of Ewh) ID 324608115593501	1206.5	385	256.5	105.35 107.75 109.44 109.33 109.45 109.58	269.65 272.71 276.56 275.85 275.55 275.42	1976 1995 2001 2007-10 2008-10 2009-10	1270 1240 1300 1260 1200 1210	1977 1995 2001 2004 2001 2008 2009
16S/9E-24D1 (W of Ewh) ID 324558115590201	349	382	233	103.66 108.13 BE 107.15 USGS 107.89 108.96 109.16 109.21	278.14 276.44 274.85 274.11 273.02 272.84 272.79	1977 1995 1995 2001 2007 2008-10 2009-10	476 466 470 466 481 497	1980 1995 2001 2007 2008 2009
16S/9E-24M1	338	380	262	98.60	282	1975 - 5	477	1975
16S/9E-34R1	101.5	335	233.5	58.00 60.33	277 274.67	1976 1989	357 430	1977 1989
16S/9E-35K1	247	362	115	84.00 89.09 90.46	280.00 272.91 271.54	1958 - 11 1974 - 12 1988	340	1972
16S/9E-25K2 MC ID 324939115593401	372 depth of hole 4000	364	8	99.70 93.99 94.06 95.08 94.63 96.51 Pumping	264.3 270.01 269.94 268.92 269.39 267.41	1975 1980 1987 1993 1996 1997	245 335 395 580 405 593 332 326 542 553 360 329 327 351 357 384 542 553 542	1974 1977 1980 1982 1986 1989 1994 1996 1997 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
16S/9E-25K4							304	1985
16S/9E-25M1 OM	262	410	148	140	270	1994	378 326 334	1962 1967 1993

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/9E-25M2 OM ID 324446115595901	336	410	74	137.60 137.42 138.39 140.71 141.06 142.17 141.35 141.08	272.81 272.98 271.93 269.29 268.94 268.04 267.83 268.65 268.92	1993 - 10 1995 - 10 2000 - 10 2004 - 3 2005 - 10 2006 - 10 2007 - 10 2008 10 2009 -10	437	1993
16S/9E-25Q1	228.5	372	243.5	104.24 107.22	267.76 264.78	1974 1993 2001	522	1974
16S/9E-26E1	38.9	250	211.3	22.20 26.95	227.8 223.05	1975 2001		
16S/9E-26E1 (a) ID 324455116003601	300	450	130	195.91 196.86 197.08 197.19	254.99 253.74 251.92 252.81	1998 2007 2008-10 2009-10		
16S/9E-26G1		440		165.32	274.68	1995		
16S/9E-26M2	278	418	140				259 302	1970 1994
16S/9E-34H1 RH ID 324424116003301	410	580	170	324.57 325.36 325.90 326.41 326.64 326.79	255.43 254.64 254.10 253.59 253.36 253.21	1995 1998 - 3 2003 - 10 2005 - 10 2007 - 10 2008 - 10 2009 - 10	309 309 349 303 304 330 308 309 302	1995 1998 1999 2001 2003 2005 2007 2008 2009
16S/9E-35A1	227	422	245				923	1975
16S/9E-35B1		476		216	260	1975 - 6		
16S/9E-35N1	500	680					384	1963
16S/9E-35N2 ID 324351116005501		680		317 315.57 316.41	283 284.43 283.59	1975 2000 2007		
16S/9E-35M1 MG ID 324345116010001	495 depth of hole 535	616	181	321 325.16 323.89 324.87 326.01 323.29 321.3 324.42 325.34 322.43 No data	295 292.84 292.11 291.13 289.99 292.57 294.70 291.58 290.66 293.57	1967 - 3 1975 - 6 1980 - 9 1985 -10 1989 - 3 1995 - 10 1996 - 10 2006 - 10 2007 - 10 2008 - 10 2009 - 10	334	1975

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3 -20-2010 2 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/9E-36G1 WW	214	385	171				350 341 356 428 635	1953 1958 1962 1973 1975
16S/9E-36G3 USG	450	354.49	-97	103.17	252.32	1995	333	1994
16S/9E-36H1 USG USG #5 about 1,700 ft. S of 36H1 ID 324407115590901	300 410	357.72 BE 342 USGS	42 -68	96.50 90.07 92.67 84.08 84.07 92.60 92.36 95.13 95.54 90.72 88.07 89.75 90.06 90.72 93.05 89.67 93.31	261.22 267.65 256.65 253.64 253.65 255.12 254.36 252.59 252.18 261.00 249.65 248.97 247.64 247.99 246.67 249.05 252.42	1954 - 5 1974 - 83 1990 - 9 1995 - 00 1996 - 10 1997 - 10 1998 - 10 2000 - 10 2001 - 10 2002 - 10 2003 - 10 2004 - 10 2005 - 10 2006 - 10 2007 - 10 2008 - 10 2009 - 10	288 332 301 305 299 297 300 321 295 295 294 279 305 301 301 300 305	1963 1972 1980 1985 1995 1995 1996 2000 2001 2003 2005 2006 2007 2008 2009
16S/9E-36G4 WW ID 324401115593201	360	382	-178	136.47 136.53 122.63 123.97 132.60 132.59	245.53 255.47 259.37 258.03 249.40 249.61	1975 1980 - 9 1985 - 90 1995 2000 - 10 2007 -10	330 353	1974 1975
16S/9E-36L1 USG	372	427	55				402	1958
16S/9E-36L2	600	410	-190	163	258	1975 - 6	293 300	1969 1975
16S/9E-36R2	394 bol	430	44	165	267.0	197 - 12		
16S/10E-14M1	1183	225	206.5	92.57 95.33	132.63 129.67	1975 1988		
16S/10E-16B1	104	215	111 bole				24000	1969
16S/10E-16M2		230		23	207	1975 - 6		
16S/10E-16Q1 2.5 mi N USG-PC	182	65	-87	52.09 45.55	12.91 19.45	1974 2001	15200	1975
16S/10E-16Q2		218		20	198	1975 - 2		
16S/10E-18P1 hurricane effect	360	340	40	30.00 Dry	230 Dry	1975 1983	15700	1975
16S/10E-20B3	79	260	181	33	227	1975		
16S/10E-24R1	301.5	335	233.5	58.00 59.36 59.89 60.33	277 275.64 275.11 274.67	1976 - 12 1980 - 9 1985 - 90 1998 - 3		

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3 -20-2010 4 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/9E-36H USG USG #6	460	350	-110	90.75	258.60	1995	406 406	1963 1996
16S/9E-36C1	157	382	225				292 355 326	1952 1953 1996 1962
16S/9E-36C2 CV ID 324436115594101	303	384	81	125	259	1975 - 6	299 367 368 354 346 355 346 364 348 354 350 359	1963 1991 1993 1995 1999 2000 2001 2003 2005 2007 2008 2009
16S/9E-36C3 CV ID 324436115594102	312	384	72	110.00 178.47 129.51 Pumping	274 205.53 254.49	1975 2001 2002 2006	314	1975
16S/9E-36D1	333	452	81				365	1975
16S/9E-36D3 ID 324425116000501	200	453	233	157.90 158.46 160.56 161.30 161.45 162.57 163.14 163.45 163.45 164.14 164.32 165.07 165.31 165.28 164.81	275.10 274.54 272.44 271.70 271.15 270.43 269.95 269.55 269.17 268.66 268.18 267.98 267.69 267.72 268.19	1975 - 6 1980 - 9 1985 - 90 1990 - 10 1995 - 10 2000 - 10 2001 - 10 2002 - 10 2005 - 10 2006 - 10 2007 - 10 2008 - 10 2009 -10	356 347	1975 1990
16S/9E-36D5 ID 324455116000501	333	450	117				365 372 360 350 358 356 357 361 352 365	1975 1992 1995 1998 2000 2003 2005 2007 2008 2009
16S/9E-36E3 USG #3	638	432	-226				595	1950

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3 -20-2010 3 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/10E-23K1 324430115555601	164	300	196	98.93 95.53 98.49 98.38 99.38 99.28	201.25 204.47 201.54 201.62 200.62 201.72	1975 1995 BE 2001 2007 2008 2009	3730	1975
16S/10E-28D1		254.33	200	29.94 29.72 29.36 29.46	223.39 223.61 223.57 223.87	1995 2007 2008 2009	6600	1948
16S/10E-29K1	80	255	206				2500	1975
16S/10E-29L1	44.45	290	231.55	23.32 29.68	250.68 260.32	1976 1988	713 660 670	1937 1983 1988
16S/10E-29M1 ID 324458115570301	35.5	251.23	215.73	22.20 22.24 23.43 25.58 26.55 27.12 27.12 27.12 27.10 27.54 27.34 26.98	229.03 229.55 227.8 225.65 224.68 224.06 224.11 224.11 224.13 223.89 223.89 224.25	1975 1980 - 9 1985 - 90 1990 - 10 1995 - 10 2000 - 10 2003 - 10 2005 - 10 2006 - 10 2007 - 10 2008 - 10 2009 - 10	54200	1975
16S/10E-29R2 ID 324420115570101	90	256	228	9.74 13.49 16.24 dry	248.26 244.51 241.76	1975 - 5 1980 - 9 1984 - 90 1985 - 90		
16S/10E-30R2	90	258	228	9.74 13.49 16.24	248.26 244.51 241.76	1975 - 5 1980 - 9 1984 - 90	1300	1958
CONTINUED								

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3 -20-2010 5 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft. above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/30E-30R1 ID 324428115581601	35	290	255				527 470 476 560 579 909 654 257 266 **801** 671 644 657 582 544 533 566 553 535 517	1957 1975 1980 1984 1985 1986 1987 1988 1989 **1990** 1993 1994 1995 1996 2000 2003 2005 2007 2008 2009
16S/30E-31B1 ID 324427115582401	255	293.01	38.01	45.32 45.50 46.89 46.95 49.40 49.46 49.15	247.70 247.45 246.09 243.89 243.55 243.86	1993 1995 2001 2006 2007 2008 2009		
16S/30E-31D1		320		61.44	258.56	197[illegible]4		
16S/30E-31D2		269		19	250	1975 - 5		
16S/30E-32L2	100	240	140				320	1975
16S/30E-32P1	210	275	65				593	1975
16S/30E-32P1 ID 324342115574301		261.58		40.16 41.35 42.77 42.52 47.24 43.51 43.49 43.70 43.65 44.02 44.27 44.28	241.42 240.23 238.81 239.06 238.29 238.07 238.09 237.88 237.73 237.56 237.31 237.3	1992 - 10 1995 - 10 2000 - 10 2001 - 10 2002 - 10 2003 - 10 2004 - 11 2005 - 10 2006 - 10 2007 - 10 2008 - 10 2009 - 10		
16S/30E-33B1	24	265	241	17	248	197[illegible]5	6930	1975
16S/30E-34N1	274	320	301	57	243.0	1974 - 5	7650	1975
16S/30E-35N2 ID 324443116005501		600		317.00 314.43 315.79 316.23 316.41 no data	283 284.57 284.21 283.77 283.59	1973 2001 2003 2005 2007 2008		

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3-20-2010 6 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft. above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/31E-23H1 1.5 mi SE USGPL ID 324660115480501	123	30	-93	39.38 44.62 50.82 51.44 51.27 51.65 51.35	-9.38 -14.62 -20.82 -21.44 -21.27 -21.65 -21.35	1974 1995 2001 2006 2007 2008 2009		
16S/31E-29L1	114	230	9[illegible]	111.00 112.05 Dry from ~20[illegible] 80	99 97.95 abs dry?	1975 1976 - 1		
16S/31E-27F3 ID 324500115492201	135	100	35	99.90 99.78 100.12 99.80 100.09 100.09	1.20 0.22 -0.12 0.20 -0.09 -0.09	1975 - 6 1995 2000 - 10 2007 - 10 2008 2009		
16S/31E-42L1 Fr/ELS fault ID 324511115522201	143.5	294.69	51.2	44.77 14.04 - el Nino 15.99 21.20 29.37 30.45 31.42	149.92 280.65 278.70 273.49 265.32 264.24 263.27	1975 1993 1995 2001 2002 2008 2009	36600	1975
16S/31E-42M1 ID 324250115521501	2	220	138	7.5 4.7 Dry	212.5 215.3	1949 1975 1983		
16S/31E-42M4							805	1975
16S/31E-42M5 W of LS fault ID 324258115524101	9.3	215.34	206.24	4.3 5.52	211.24 210.02	1949 1995		
17S/30E-11A1	340	382	52				446	1975
17S/30E-11A2 NE of 11G1	360	373.96	13.96	166.67	207.29	1995	150 331	1972 1975
17S/30E-11G2 affected by export from well 11G1 N of 11G1	335	375	60	158.00 164.00 164.45 165.09 166.64 166.93 172.38 176.05	217 211 210.55 209.91 208.36 208.07 202.62 198.95	1971 - 11 1975 - 6 1977 - 10 1978 - 3 1979 - 9 1980 - 9 1981 - 11 1982 - 10	335 363 369 370 377 377 392	1972 1977 1978 1979 1980 1982 1982

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3-20-2010 8 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft. above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
16S/30E-40R1		286		49	237	1974 - 10		
16S/30E-41D1		324					242	1963
16S/30E-41D2		320					454	1962
16S/30E-41G1	65	284	219				2970	1975
16S/30E-41M3	150	340	190	71	269	1971 - 10	2300	1975
16S/30E-41Q1	47	300	253				2190	1975
16S/30E-42A1	130	334	204	57.72 88.22	246.28 245.78	1935 - 10 1996 - 10	464	1974
16S/30E-42A2		336		73.21 76.43 80.59	262.79 259.62 255.41	1974 1984 1994	537	1974
16S/30E-42A3	146	330	184				392	1974
16S/30E-42A4		350		78.00	257.0	1974 - 12	554	1995
16S/30E-42A5 ID 324329115580501		328		73.21 74.95 76.20 79.64 80.50	254.79 253.04 251.80 248.36 247.41	1974 - 12 1980 - 9 1983 - 10 1989 - 10 1994 - 3	415 418 463 455 410	1974 1979 1983 1989 1994
16S/30E-42A7	93	318	225				583	1975
16S/30E-42A8 ID 324323115580001	112	325	213				3066 986 951 964 851 891 958 868 935 901	1994 1996 1999 2001 2003 2005 2006 2007 2008 2009
16S/30E-42C1	330	380	50				4420	1975
16S/30E-42H1	350	362	12	109 173.20 172.36 172.42 171.29 170.95	253 188.8 189.64 189.58 190.71 191.05	1971 - 10 2001 - 10 2003 - 10 2004 - 11 2005 - 10 2006 - 10	668	1975
16S/30E-42H2		342		44	258	1975 - 6		
16S/30E-42H3	167	345	178					

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3-20-2010 7 of 11

Well USGS ID (T/R-S) USGS Site ID #	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft.	Groundwater elevation ft. above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
17S/30E-11G1MW export starts 9/1/77 lawsuits export stops 9/1/82 also a few months of export pumping in 1972, stopped by court ID 324123115552001	300	380.14	80.14	170 164.94 165.13 165.58 225.68 232.60 221.20 195.66 167.63 185.31 162.68 162.45 161.90 179.45 177.59 176.03 178.89 177.15 176.52 176.55 175.20 174.98 174.03 173.20 172.36 172.42 171.29 170.95 171.21 No data No data	210.14 202.00 215.03 164.56 154.66 147.54 158.94 184.24 192.51 194.83 197.46 197.66 199.64 201.09 202.55 202.11 201.25 202.68 203.62 203.79 204.94 205.55 206.1 206.94 207.75 207.72 208.85 209.18 208.93	1967 - 4 1975 - 6 1976 - 1 1978 - 7 1980 - 9 1981 - 11 1982 - 10 1983 - 10 1984 - 10 1985 - 10 1986 - 10 1987 - 10 1988 - 10 1989 - 10 1990 - 10 1991 - 10 1992 - 10 1993 - 10 1995 - 10 1996 - 10 1997 - 10 1998 - 10 1999 - 10 2000 - 10 2001 - 10 2003 - 10 2004 - 11 2005 - 10 2006 - 10 2007 - 5 2008 2009		
17S/30E-11G4 see last page								
17S/30E-11H1 affected by export from well 11G1 N/E of 11G1 ID 324230115552001	302	376	75	156.60 152.90 159.53 161.09 162.42 163.03 163.49 163.30 164.05 163.72 163.87 163.62 162.53 160.62 160.28 159.99 159.84 159.21 158.61 158.39	219.2 223.1 216.47 214.94 213.53 212.97 212.51 212.7 211.95 212.28 212.13 212.38 213.47 215.08 215.72 216.01 216.46 216.79 217.39	1975 - 6 1978 - 6 1979 - 9 1980 - 9 1981 - 11 1982 - 10 1984 - 10 1986 - 10 1988 - 10 1990 - 10 1993 - 10 1996 - 10 1999 - 10 2001 - 10 2004 - 11 2005 - 10 2006 - 10 2007 - 10 2008 - 03 2009 - 10 2020 - 3		

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 3-20-2010 9 of 11

Well USGS ID (TR-S) USGS Site ID +	Well depth ft.	Land Surface Elevation ft.	Base of well ft. above sea level	Static water level below ground surface ft	Groundwater elevation ft above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
12S/10E-11H1 affected by export pumping of 11H1 S of 11G1	5293	380	50.1	158.27 164.2 166.05 170.46 173.35 180.38 174.43 171.69	221.73 215.80 213.95 209.54 206.65 199.65 205.87 208.31	1964 - 8 1970 - 9 1979 - 9 1980 - 9 1981 - 11 1982 - 10 1983 - 10 1985 - 10		
12S/10E-11H2 affected by export from well 11G2 SE of 11G1 well failed 4/87	544	376	32	165.00 169.80 176.29 180.56 184.43 189.82 187.34 186.19 190.22 187.41	211 206.6 199.21 195.54 191.57 186.13 188.66 189.25 185.73 188.59	1973 1978 - 6 1979 - 9 1980 - 10 1981 - 10 1982 - 10 1983 - 10 1984 - 10 1985 - 10 1986 - 10	300 295 295	1983 1984 1985 1986
12S/10E-11H3 930.5 ft SE of 11G1 replacement shortside for 11H2 affected by export from well 11G1, shows recovery ID 324133115552001	548	380	32	179.29 180.11 179.08 178.57 178.32 176.89 174.26 175.68 172.88 171.69 170.99 171.38	200.71 199.89 200.92 201.43 201.68 203.11 205.74 204.36 207.12 208.31 209.01 206.6	1987 - 10 1988 - 10 1989 - 10 1990 - 10 1995 - 10 1997 - 10 2001 - 10 2003 - 10 2005 - 10 2007 - 10 2008 - 10 2009 - 10	313 311 319 316 312 309 311 307 313 299 289	1987 1988 1989 1991 1995 1997 2001 2003 2005 2007 2008 2009
12S/10E-19K1	150	341.6	192	136.7 136.2 135.3 135.52	204.90 205.4 205.9 206.04	1975 - 12 1980 - 9 1985 - 10 1989 - 3	431	1975
12S/10E-19F1		320		546.05	-226.05	1974 - 10		
12S/11E-22Q2 ID 323923411500401	319.6	303.9	184.3	102.48 97.36 97.51 97.16	201.42 206.52 206.39 206.74	1975 2007 2008 2009		
12S/11E-16J1 ID 324013115511101	366	298.9		96.63 96.06 95.44 95.0 94.53 93.76 93.93 93.68 93.44 93.17	202.07 202.64 203.26 203.7 204.17 204.94 206.77 207.02 207.26 207.53	1972 1974 1980 1985 1991 1995 2000 2006 2007 2008 2009		

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 7-29-2010 10 of 11

Well USGS ID (TR-S) USGS Site ID +	Well depth ft	Land Surface Elevation ft	Base of well ft. above sea level	Static water level below ground surface ft	Groundwater elevation ft above mean SL = AMSL	Elev. AMSL Year	mg/l Total Dissolved Solids	TDS Year
12S/10E-21G4 MM unused well affected by export from well 21G1 unused 967 ft W of export well 11G1 ID 324139115553201	500	382.14	-118	191.35 190.32 206.25 189.51 193.25 189.71 187.22 185.92 184.26 183.47 182.14 180.70 180.98 180.10 179.55 178.46 178.0 177.34 176.3 175.66 174.98 173.47 173.21 172.95 172.62 171.94 171.14 170.89 170.50 169.92 169.64	190.79 191.82 175.89 182.93 188.99 192.43 194.92 196.22 197.88 196.67 200.00 201.44 202.06 202.64 203.56 203.96 204.10 204.80 205.84 206.48 207.20 208.27 208.93 209.19 209.52 210.20 211.01 211.25 211.64 212.22 212.5	1938 - 8 1941 - 2 1982 - 10 1983 - 10 1984 - 10 1985 - 10 1986 - 10 1987 - 10 1988 - 10 1989 - 10 1990 - 10 1991 - 10 1992 - 10 1993 - 10 1994 - 10 1995 - 10 1996 - 10 1997 - 10 1998 - 10 1999 - 10 2000 - 10 2001 - 10 2002 - 10 2003 - 10 2004 - 11 2005 - 10 2006 - 10 2007 - 10 2008 - 10 2009 - 10 2010 - 3		

NOTES
* TDS Total dissolved solids in mg/L
(a) All 2010 water level data is information from USGS Water Resources website: http://nwis.waterdata.usgs.gov/ca/nwis/gwlevels
AMSL Above Mean Sea Level static water level as feet above mean sea level measures groundwater level without confusing information about topography such as slopes or depressions
(b) Water quality data are from USGS Water Resources website at http://www.waterdata.usgs.gov/ca/nwis/qwdata
(c) USGS well location maps & data for Imperial County, links to individual wells
http://ca.water.usgs.gov/groundwater/publications/Region_A_635.html
USGS 1989 Groundwater Quality Data Ocotillo Coyote Wells Area, HOS Appendix F, USG DEIR Appendix B-1 BE = Bookram-Edmonston groundwater study prepared for US Gypsum
HOS Appendix F, HUSO64 revised DE study for USGypsum DEIR 2008
CV Coyote Valley Mutual Water Co. Serves residential subdivision Ocotillo Unit 2
MC McDougal/Clifford export well also served Ocotillo Unit 3 until 1984 when it stopped exporting groundwater
MY McDougal Yuha well, exported water for a few months in 1972 and from 1973 - 1982, domestic only since that time
MM McDougal unused well, drilled to depth but did not get potable water
MG Muller's Garage N of I-8 just E of jct w Hwy 98
OM Ocotillo Mutual Water Co. Serves residential subdivision Ocotillo Unit 1
RH Hamilton 1.25 mi W of CV Mutual Water Co. Furthest west well in the USGS monitoring program
USG US Gypsum wells export water to Plaster City factory
WW Western Pod Water Co A private water co provides water by truck to residences in West Texas and Painted Gorge
USGS Hydrologic Unit Code 18100200

Exhibit 39 Water well information, groundwater elevations, water quality for Ocotillo/Coyote Wells Groundwater Basin 7-29-2010 11 of 11

FILED
Clerk of the Court of Appeal, Fourth District
OCT 26 2000

NOT TO BE PUBLISHED IN OFFICIAL REPORTS

COURT OF APPEAL, FOURTH APPELLATE DISTRICT

DIVISION ONE

STATE OF CALIFORNIA

SIERRA CLUB, Plaintiff and Appellant, v. IMPERIAL COUNTY et al., Defendants and Respondents. UNITED STATES GYPSUM CO., Real Party in Interest and Respondent.	D0D034281 (Imperial County Super. Ct. No. 979111)

APPEAL from a judgment of the Superior Court of Imperial County, Joseph W. Zimmerman, Judge. Reversed with directions.

Sierra Club appeals from a judgment denying it a writ of mandate to set aside a negative declaration under the California Environmental Quality Act (CEQA) and require the preparation of an environmental impact report (EIR). In 1998, Imperial County (County) issued a negative declaration for a project to expand and modernize the wallboard manufacturing plant of United States Gypsum Company (USG) in Plaster City (Plaster City plant). Sierra Club contends (1) the record includes substantial evidence to support a fair argument the project may result in significant impacts to groundwater and traffic and (2) the project description was inadequate because it did not include a description of the increase operations of USG's quarry. Because we conclude there is substantial evidence supporting a fair argument significant environmental impact may occur as a result of the Project's increased use of groundwater and increase in truck traffic, we conclude the County abused its discretion in certifying the negative declaration. Accordingly, we reverse the judgment with directions.

FACTS AND PROCEDURAL HISTORY

On July 31, 1998, USG submitted an application to the County Planning Department to expand and modernize its Plaster City plant by installing a new wallboard facility and disassembling production line number 2 (the Project). The Project will double the plant's production from 500 million to 1 billion square feet of wallboard. The Project will require USG to increase its use of well water from about 400 acre-feet (AF) per year to 767 AF. The Project will also increase USG's use of gypsum from its quarry, located approximately 26 miles from the plant, by almost 800,000 tons or 70 percent. USG also proposes relocating the railroad to south of the Project site.

On August 20, 1998, USG met with County representatives to discuss the Project. At that meeting, the County representatives outlined the permits that would likely be required, including water, air quality, and mining. USG then submitted a project

description to the County and an application for authority to construct to the County Air Pollution Control District.

In October 1998, the County Planning Department prepared an initial environmental study of the Project. The study states the Project could have a potentially significant impact on groundwater because USG's proposed use of 767 AF represents a substantial increased use over USG's reported prior use, which averaged 493 AF over the past 30 years. Although USG claims to have used 787 AF one year in the past, there is no back-up data to support that claim. Further, during its 10 highest years of use, USG averaged only 610 AF. The report also states the Project may have a significant effect on road maintenance unless mitigated because the California Department of Transportation and Public Works (Caltrans) may require road easements, road improvements, and encroachment permits for public roads, including I-80.

On October 29, 1998, the County Environmental Evaluation Committee (EEC) held a public meeting during which it reviewed the initial study with a representative of USG. When the County passed its Groundwater Management Ordinance, it limited USG's use of groundwater to 767 AF. Because USG's projected use is at that limit, the EEC voted to change the impact on groundwater to a less than significant impact. The EEC required USG to hire a traffic engineer to do a traffic study comparing current traffic patterns to post-Project traffic patterns. When USG expressed concern about paying for road improvements resulting from the study, the EEC explained that it did not have authority over road improvements and USG would have to work the with County Department of Public Works (Public Works). After USG agreed to the traffic study, the

EEC voted to change the impact on roads to a less than significant impact. The EEC then recommended the approval of a negative declaration for the project.

On December 9, 1998, the County Planning Commission held a public hearing. During that meeting, representatives of the Sierra Club argued an EIR should be prepared based upon its submission of letters and documents. At that meeting, the Planning Commission unanimously approved the negative declaration. It filed the notice of determination on December 15, 1998.

In January 1999, Sierra Club petitioned for a writ of mandate directing the County to set aside the negative declaration and permits, and further directing the County to prepare an EIR. After a hearing, the court denied the petition on July 20, 1999.

DISCUSSION

I. Standing

USG has raised jurisdictional concerns, which we must resolve before reaching the Sierra Club's contentions. USG contends the Sierra Club lacks standing because it did not object to the approval of the project as required by Public Resources Code[1] section 21177, subdivision (b). Section 21177, subdivision (b) states: "No person shall maintain an action or proceeding unless that person objected to the approval of the project orally or in writing during the public comment period provided by this division or prior to the close of the public hearing on the project before the issuance of the notice of determination."

USG does not dispute that the Sierra Club wrote two letters objecting to the County's proposal to grant a negative declaration during the public comment period. Instead, USG contends that although the Sierra Club objected to the granting of the negative declaration, it did not object to the approval of the project because it did not specifically object to the project. USG bases its contention upon a statement made by James Harmon, a Sierra Club member, who said, "We are not opposed to USG. All we're asking them is to seriously consider taking IID [Imperial Irrigation District] water. That would be the safest way."

USG contends a party must object to the project, not the "approval of the project" as required by section 21177, subdivision (b). USG bases this contention on the legislative history. However, when a statute is clear on its face, we need not look at the legislative history. (*Delaney v. Superior Court* (1990) 50 Cal.3d 785, 798.) By objecting to the granting of a negative declaration, the Sierra Club objected to the "approval of the project." Moreover, the Sierra Club also objected to the project itself. For example, the Sierra Club contended USG's increased use of groundwater would prevent future residential development. Even the statement by James Harmon upon which USG relies is an objection to the Project's proposed use of groundwater. Therefore, the Sierra Club has standing under section 21177, subdivision (b).

[1] All further statutory references are to the Public Resources Code unless otherwise specified.

II. Standard of Review

CEQA requires agencies to prepare an EIR for a proposed project "whenever it can be fairly argued on the basis of substantial evidence that the project may have significant environmental impact." (*Quail Botanical Gardens Foundation, Inc. v. City of Encinitas* (1994) 29 Cal.App.4th 1597, 1602 [hereinafter *Quail Botanical Gardens*] quoting *No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68, 75.) The CEQA Guidelines (Cal.Code Regs., tit. 14, § 15000 et seq. [hereinafter Guidelines]) define a significant effect on the environment as a "substantial, or potentially substantial adverse change in any physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance." (Guidelines, § 15382.)

The Sierra Club contends it presented substantial evidence USG's expansion will have significant environmental impact on groundwater and traffic. When a plaintiff challenges an agency's decision no EIR is required, we review the administrative record de novo to "determine whether there is substantial evidence in support of a fair argument [the proposed project] may have a significant environmental impact . . . ." (*Quail Botanical Gardens, supra*, 29 Cal.App.4th at p. 1603.) Substantial evidence, which includes "facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts," is "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached." (Guidelines, § 15384.) When determining whether substantial evidence supports a fair argument, we also consider "[e]vidence that rebuts,

contradicts or diminishes the reliability or credibility of appellants' evidence . . . ." (*Citizens' Com. to Save Our Village v. City of Claremont* (1995) 37 Cal.App.4th 1157, 1168.) Although we do not give deference to the agency's decision, we do give the agency "the benefit of the doubt on any legitimate, disputed issues of credibility. In effect, we apply a hybrid, quasi-independent standard of review." (*Quail Botanical Gardens, supra*, 29 Cal.App.4th at p. 1603.)

III. *Groundwater*

The Sierra Club contends USG's project would have a significant effect on groundwater due to USG's increasing its usage of groundwater to 767 AF. During the public comment period, Sierra Club submitted a 1993 letter written by Dr. David Huntley, Professor of Geological Sciences, who had conducted a number of groundwater studies for the County. That letter concluded USG's water usage should remain at 380 AF to prevent degradation of the water supply.

A. *Ocotillo-Coyote Wells Hydrologic Basin*

USG is the largest user of water from the Ocotillo-Coyote Wells hydrologic basin (Basin). The Basin is bordered by the Jacumba Mountains on the west, the Coyote Mountains on the north, the Westside Main Canal on the east, and the Mexican border on the south. The Basin receives its water from mountain runoff, rainfall in the valley either evaporates or is absorbed by the desert flora. The Elsinore fault bisects the Basin and separates potable groundwater in the west from very saline water to the east.

The Basin has been designated a sole source aquifer by the Environmental Protection Agency because it is the sole source of drinking water for the towns of

Ocotillo, Nomirage, Yuha Estates and Coyote Wells, which have a combined population of about 500 people. Groundwater levels in the Basin have declined since the 1920's, when significant pumping began. Pumping increased until 1984 and then declined due to the cessation of exports to Mexico. Additionally, the amount of water used at the Plaster City plant increased from approximately 150 AF in 1925 to approximately 600 AF in 1975. Based upon its production records, USG pumped about 400 AF in 1976; pumping increased to about 520 AF in 1986-1989; and pumping then decreased to 400 AF in 1995.[2]

The greatest concern of the Basin's users is the degradation of the water supply that would occur if groundwater levels decreased substantially, causing the saline water east of the Elsinore fault to flow across the fault into the potable water in the western portion of the Basin. Therefore, numerous studies have been conducted to determine a safe yield for the Basin. The safe yield is defined as the maximum sustainable pumping level that would (1) result in stable groundwater levels, (2) maintain the existing flow of the groundwater (to prevent degradation of the potable water), and (3) allow full production from existing wells.

One of the earlier studies of the Basin was conducted in 1977 by James Skrivan of the United States Geological Survey (USGS). He analyzed how various pumping levels

2 Bookman-Edmonston could not reconcile USG's water use calculated from USG's production reports with the water use USG reported to the United States Geological Survey, which showed levels 70 percent greater than production use levels. Further, USG admits "[t]he data used to determine these older water use levels [1966-1975] have not been located." Therefore, USG's claimed use of 767 AF in 1972 can not be verified.

would affect the Basin's groundwater over the next 20 years.[3] He found (1) continued pumping of 1,000 AF per year would lower groundwater 6 feet; and (2) pumping of 2,000 AF per year would lower groundwater 17 feet, resulting in equal groundwater levels on both sides of the Elsinore fault and causing saline water intrusion by 1995.

In 1979, David Huntley updated and evaluated the 1977 USGS report for the County. He concluded the then current pumping of approximately 1,000 AF per year exceeded the safe yield of the Basin and saline water intrusion could occur as early as 1985. In 1980, Huntley concluded the then current overdraft was 291 AF.

In 1993, Huntley reviewed existing groundwater data and determined that even though USG had reduced its use of groundwater, groundwater levels continued to decline in all but one of the wells in the area where USG's wells are located. In addition, the chloride concentration of the water in USG well 16S/10E/30RI (Well 16), a well located near the transitional area between fresh and saline water, increased significantly between 1977 and 1990. As a result, Huntley recommended USG's total groundwater production be limited to 380 AF per year; additional monitoring wells be drilled and monitored quarterly; and any permits for amounts larger than 380 AF allow the County to modify the permit should water quality decline.

In December 1995, Montgomery Watson developed a county-wide groundwater model for the County Public Works Department (MW Study), using hydrologic data from

3 The 1977 Skrivan report, the 1979 Huntley report, and the 1980 Huntley report are not in the administrative record. The Bookman-Edmonston study summarized these studies, as well as other studies, in its review of the literature.

1970 through 1990. That model calculated the Basin's safe yield at 2,000 AF. The MW Study qualifies this conclusion, however. The MW Study analyzed the Basin's safe yield in order to show the utility of the model, not to determine future water use. "The actual safe yield of each sub-basin should be determined based on physical, hydrological, economical, and land use planning criteria, using the groundwater model."

The most recent study was prepared in March 1996 for USG by Bookman-Edmonston Engineering, Inc. [BE Study]. The BE Study found groundwater levels declined 380 AF per year from 1976-1982 and 160 AF per year from 1983-1995. The study updated water quality tests and found water quality constant except for Well 16. The total dissolved solids in that well increased from approximately 480 mg/l in 1978 to a high of 794 mg/l in 1990. Since then, the levels have decreased, dropping to approximately 657 mg/l in 1995, a 37 percent increase over the 1978 level. The BE Study speculates the change in dissolved solids may have been caused by irrigation in a nearby orchard, which had been abandoned shortly before the study was conducted.

The BE Study determined the Basin's safe yield to be 1,000 AF, using a 100-year time horizon. Pumping of that amount will lower the Basin's groundwater level by about 5 feet in the next 100 years, although the groundwater level near USG well No. 5 will decline by about 20 feet. According to the study, this decline will not degrade the quality of the groundwater or reduce production from the Basin. If current pumping were tripled to 1,500 AF, an amount higher than the safe yield, groundwater levels would decline substantially by 2025: about 14 feet in Ocotillo and 15 feet at USG well No. 5. Although there would be no degradation of the quality of the water throughout the Basin, one well

close to the Elsinore fault would experience increased concentrations of dissolved solids over the next 100 years from 1,250 mg/l to 4,000 mg/l.

B. *Disagreement Among Experts*

When experts disagree about the significance of an effect on the environment and the experts' opinions are supported by the facts, the agency must treat the environmental effect as significant and prepare an EIR. (Guidelines, § 15064, subd. (g); *Quail Botanical Gardens, supra*, 29 Cal.App.4th at p. 1607.) The agency has the discretion, however, to disbelieve an expert if he is biased or if his opinion is inherently improbable or unsupported by the facts. (*Brentwood Association for No Drilling, Inc.* v. *City of Los Angeles* (1982) 134 Cal.App.3d 491, 504; *Citizens Association for Sensible Development of Bishop Area* v. *County of Inyo* (1985) 172 Cal.App.3d 151, 173.)

The Sierra Club contends the 1993 Huntley letter represents an expert opinion supported by facts. In that letter, Huntley reviewed an earlier USG proposal to decrease its use of groundwater in the short-term, but to increase its production of groundwater by 170 AF in the long-term. Huntley based his analysis on the USGS groundwater database and survey records, using data through 1993. His data showed declining groundwater levels in the Ocotillo area; USG Well No. 5 declined about 4 feet from 1976 through 1993. He concludes from this decline that there is a localized overdraft in the Ocotillo portion of the Basin. Additionally, from 1976 to 1990 there was a significant increase in chloride in Well 16, a well immediately west of the transitional area near the Elsinore fault that would likely be the first well to experience water degradation. However, none of the other wells show an increase in chloride, even other wells near the transitional

area. The letter states: "It is therefore unclear from the existing data whether the changes seen in [Well 16] are localized or an indication of salt water intrusion into the Ocotillo basin." The letter concludes USG should not be allowed to increase its production beyond 380 AF until future data allay concerns about potential overdrafts and water quality degradation.

The 1996 BE Study used data through 1995. Therefore, it has two years more data than Huntley. The BE Study agrees with Huntley that water levels in the Ocotillo area have fallen about four feet. It also shows the Basin's water supply has been decreasing, even at the current level of pumping. Based upon the model it developed, however, the BE Study concludes the safe yield is 1,000 AF. At that level, it opines that groundwater levels will continue to fall but will eventually stabilize.

The BE Study adds information about the quality of the water in Well 16. USGS data show dissolved solids increased until 1990 when they began to decrease. However, 1995 levels are 37 percent higher than 1978 levels. The BE Study disagrees with Huntley about the significance of the increased level of dissolved solids and states that "one possible explanation" of this increase is agricultural irrigation.

Comparisons of these studies reveal they are based on the same facts; the BE Study has two additional years of data. However, Huntley and the BE Study disagree about the significance of the facts. Huntley sees the decline in the groundwater levels as significant; the BE Study does not see the decline as significant. Neither expert is confident of its explanation as to why the chloride levels in Well 16 increased significantly from 1978 until 1990. Further, both experts acknowledge the data do not

provide a definitive analysis of groundwater movement. The BE Study states: "As previously stated, the Ocotillo/Coyote Wells Groundwater Basin has not been stressed (by groundwater pumping) to the point of causing poor quality groundwater movement. Therefore, *limited data is available for completely calibrating movement of [saline] water* caused by groundwater pumping. It is therefore recommended that the current USGS groundwater quality monitoring program be continued." (Italics added.)

Neither the Huntley letter nor the BE Study is an analysis of the Project. Both studies, however, contemplate increasing USG's pumping of groundwater. The BE Study specifically discusses doubling the pumping of each of the Basin's users; such a doubling would increase UGS's pumping from 400 AF to 800 AF. Huntley's letter contemplates increasing UGS's pumping from 380 AF to 550 AF. Because neither study was prepared for environmental review of this project, neither study explicitly states whether USG's increased pumping will have a significant adverse effect on the environment. However, each study implicitly comes to a conclusion on this issue. The purpose of the safe yield analysis is to determine the amount of groundwater that may be pumped without causing a significant adverse effect on the environment. The BE Study determined that doubling the current pumping, which result in an amount slightly higher than the Project proposes (800 AF versus 767 AF), will be within the safe yield and so will have no adverse effect on the environment. In contrast, Huntley's 1993 study concluded that increasing USG's pumping to 550 AF could lead to degradation of the water supply -- which would be a significant adverse effect on the water supply. Therefore, these two experts disagree on the question of whether the Project will have a significant adverse effect on groundwater.

We reject USG's contention that its study is superior because it is more conservative than the MW Study. The MW Study is not a study of USG's increased water use; it is a regional study whose purpose was to assist the County in its management of water from the Colorado River. Further, the MW Study specifically warned that its results should not be used for local sub-basin analysis. Therefore, the MW Study does not provide support for USG's position.

We also reject USG's contention that the 1993 Huntley letter does not constitute substantial evidence because it is outdated. Huntley's 1993 opinion is not like the expert opinion that did not constitute substantial evidence in *Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1369. There, the expert's opinion was not grounded in an adequate factual foundation because the expert relied upon unspecified information given to him over the telephone and his general knowledge of the area. (*Id.* at pp. 1421-1422.) As explained above, Huntley relies upon the same USGS data as the BE Study; the BE Study contains only two additional years of data. The different conclusions reached by Huntley and by the BE Study depend upon their use of different recharge estimates and different specific yields. Yet the BE Study relies upon the 1977 USGS Study for its recharge estimates. Because the BE Study relies upon the older studies and models for some of its analysis, we cannot simply conclude those older studies are no longer valid. Therefore, the different conclusions reached by Huntley and the BE Study require the preparation of an EIR.

C. *Groundwater Ordinance*

USG contends an EIR is not required because the County's Groundwater Management Ordinance (Ordinance) mitigates the potential impacts of the Project to a level of insignificance. We disagree.

Ordinance section 92204.00 establishes priority among groundwater users in the event of an overdraft. Priority is given first to residential users, second to historical county users, third to other overlying groundwater users, and fourth to other County off-basin users. (Ordinance, § 92204.00, subd. (A).) An historical county user has priority up to its maximum rate of use within the last 30 years. (Ordinance, § 92204.00, subd. (A)(2).) Based on information submitted by USG, the County determined USG has priority of 767 AF as an historical user. However, USG has admitted that it has no data to back up this use, which occurred in 1972. More troubling is that Bookman-Edmonston, USG's own experts, could not reconcile USG's reported water use to USG's production records for the years 1970 to 1975, which are the years in which USG reported its highest water use.[4] Bookman-Edmonston found the amounts USG reported were 70 percent greater than the amounts calculated from the production reports. If we reduced USG's 1972 water use 70 percent, it would have priority of only 451 AF as an historical user. USG's 1972 water use is important in that the EEC decided the Project

4 USG's reported use of water in the years from 1970 to 1975 is, in order: 568, 575, 767, 638, 691, 614 AF. The next highest year is 1969, during which USG reported using 560 AF. USG's average use of water during those five years is 659 AF. If we reduce that average by 70 percent, as suggested by Bookman-Edmonston, the average becomes 388 AF, an amount almost equal to its 1996 use of 367.

would not have a significant effect upon groundwater because USG's planned use of water was within this historical use of 767 AF.

Further, these priorities are triggered by an overdraft or the threat of an overdraft: "[t]he Commission shall, after notice to the public and a hearing which discloses competent evidence of overdraft in a groundwater basin, or threat of overdraft, reduce or suspend extraction and /or exportation [of groundwater]." (Ordinance § 92204.01.) An overdraft is defined as "the condition of a groundwater basin where the average annual amount of water extracted exceeds the average annual supply of water to the basin plus any temporary surplus." "Extraction" is defined as the act of obtaining groundwater by pumping. "'Temporary surplus' means the amount of water that can be extracted . . . without adversely affecting the available supply or groundwater quality of the groundwater basin . . . . According to the BE Study, the Basin is losing more water than it is receiving. From 1976-1982, the average discharge (which includes pumping, water flow out of the Basin, and evapotranspiration) exceeded the average recharge by 380 AF. From 1983-1994, the average discharge exceeded the average recharge by 160 AF. It is not clear whether the Basin is in an overdraft condition based upon the definitions contained in the Ordinance or whether the excess water extracted is part of the "temporary surplus." Hunley believes the Basin is in an overdraft condition. Given that experts can disagree about whether the Basin is in an overdraft condition, there can be disagreement about when the priorities in the Ordinance are triggered. For that reason, the record provides substantial evidence of a fair argument the Ordinance does not protect residential users from USG's potential overuse of groundwater

Because the experts disagree about whether the Project will have a significant adverse effect upon groundwater, the County abused its discretion by approving a negative declaration.

IV. *Traffic*

The Sierra Club contends the administrative record contains substantial evidence the Project will have a significant adverse effect upon traffic. USG's initial application stated there would be increased truck traffic within the capacity of the current highways. The initial environmental study noted a potentially significant effect on traffic unless mitigated. At the EEC hearing, the Public Works's representative stated he found the increased traffic a potentially significant impact unless mitigated and requested that USG contract with a traffic engineer to prepare a traffic study to show post-Project traffic patterns. After USG agreed to prepare a traffic study and to negotiate with Public Works concerning any road improvements to be made as a result of the study, the Public Works representative withdrew his finding that the traffic impact was potentially significant unless mitigated. During the administrative review process, Caltrans requested a traffic study to analyze the Project's impact on the I-8/Dunaway Road interchange, discuss appropriate mitigation, and required USG to pay its "fair share" towards that mitigation. After the EEC hearing and prior to the County Commission hearing, Public Works summarized the conditions it requested at the EEC meeting as (1) a traffic study addressing any impact at Evan Hewes Highway at the UGS plant site, including any necessary left or right turn lanes; and (2) USG to pay for any needed road improvements.

No members of the public raised concerns about traffic during the public comment period.

USG contends the Sierra Club failed to exhaust its administrative remedies because no members of the public raised the traffic issue prior to the close of the public hearing. Section 21177, subdivision (a) provides in part: "No action or proceeding may be brought pursuant to Section 21167 unless the alleged grounds for noncompliance with this division were presented to the public agency orally or in writing by any person . . . ." The purpose of the exhaustion doctrine is to insure the public agency is notified of factual and legal problems and has an opportunity to respond to these potential problems prior to judicial review. (*Coalition for Student Action v. City of Fullerton* (1984) 153 Cal.App.3d 1194, 1198.) Section 21066 defines "person" as follows: "'Person' includes any person, firm, association, organization, partnership, business, trust, corporation, limited liability company, company, district, county, city and county, city, town, the state, and *any of the agencies and political subdivisions of those entities*, and, to the extent permitted by federal law, the United States, or any of its agencies or political subdivisions." (Italics added.) Because county and state agencies are persons under CEQA and the County Department of Public Works and Caltrans each raised concerns about traffic, the Sierra Club exhausted its administrative remedies under section 21177.

The Sierra Club contends there is substantial evidence to support a fair argument of a significant impact on traffic based upon Public Work's and Caltran's request for a traffic study. USG responds that the mere request for a study, without more, is not evidence to support a fair argument. The problem with USG's response is that the

purpose of the traffic study is to develop the facts needed to determine whether the impact will be significant: "While a fair argument of environmental impact must be based on substantial evidence, mechanical application of this rule would defeat the purpose of CEQA where the local agency has failed to undertake an adequate initial study. The agency should not be allowed to hide behind its own failure to gather relevant data. . . . CEQA places the burden of environmental investigation on government rather than the public. If the local agency has failed to study an area of possible environmental impact, a fair argument may be based on the limited facts in the record. Deficiencies in the record may actually enlarge the scope of fair argument by lending a logical plausibility to a wider range of inferences." (*Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 311; see also *Oro Fino Gold Mining Corp v. County of El Dorado* (1990) 225 Cal.App.3d 872, 884.) Here, the record reveals the Project will double production at the Plaster City plant from 500 million to 1 billion square feet of wallboard. USG's application stated there would be additional truck traffic, but did not specify how much additional traffic. Given that production will double, traffic will likely increase significantly. Clearly, both Public Works and Caltrans believe it likely the additional traffic would require road improvements. Therefore, the record contains substantial evidence from which a fair argument could be made that increased traffic will have a significant effect on the environment.

We reject USG's contention there is no substantial evidence because the Public Works representative withdrew his finding of a significant impact unless mitigated when USG agreed to have a traffic study prepared. The Public Works representative

incorrectly believed that the traffic study itself would mitigate its finding, given that USG would agree to make any improvements recommended by the study. However, "[a] requirement that the applicant adopt mitigation measures recommended in a future study is in direct conflict with the guidelines implementing CEQA." (*Sundstrom v. County of Mendocino*, *supra*, 202 Cal.App.3d at p. 306 [relying upon Guidelines, § 15070, subd. (b)(1)].) On the other hand, "a mitigation condition that depends on the future formulation of a mitigation plan may be valid, provided the lead agency recognizes the significance of the potential environmental effect, commits itself to mitigating its impact, and articulates specific performance criteria for the future mitigation. [Citation.]" (*Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1359, 1411.) Here, the County had not recognized the significance of the increased traffic; that was the purpose of the study. Therefore, the County could not rely upon a future study to determine mitigation measures. The County abused its discretion by adopting a negative declaration before completing the traffic study.

V. *Project Description*

The Sierra Club contends the description of the Project is inadequate because it does not describe the increased quarry operations to supply the additional gypsum needed for the increased production at the Plaster City plant. In addition to describing the expansion of the Plaster City plant, the Project description states: "Additionally the applicant proposes to relocate the existing San Diego Arizona Eastern Railroad and relocate it to south of the project site. Increase the current trainloads from the existing U[.]S. Gypsum Co. Railroad, which delivers raw materials from U.S. Gypsum's Quarry

located approximately 26 miles northwest of the site. . . ." The map and environmental information USG submitted, which were included in the public notice, show or mention the quarry.

"'Project' means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment . . ." (Guidelines, § 15378, subd. (a).) "'Project' is given a broad interpretation in order to maximize protection of the environment." (*McQueen v. Board of Directors* (1988) 202 Cal.App.3d 1136, 1143.) CEQA mandates "environmental considerations do not become submerged by chopping a large project into many little ones -- each with a minimal potential impact on the environment -- which cumulatively may have disastrous consequences." (*Bozung v. Local Agency Formation Com.* (1975) 13 Cal.3d 263, 283-284.)

Although the Project description did not specifically mention the increased operations of the quarry, it implied the quarry's operations would increase by stating that the trainloads of materials from the quarry to the Plaster City plant would increase. This is enough to give notice that the Project includes increased quarry operations. (See *Temecula Bank of Luiseno Mission Indians v. Rancho Cal. Water Dist.* (1996) 43 Cal.App.4th 425, 433-434 [even though an important aspect of a project was not included in project description, appellants had notice because the district made it clear during hearing at which appellants appeared].) No party objected to the County's failure to consider the increased operations at the quarry. During the public comment period, the Sierra Club stated the project description was vague, but failed to explain why it was

vague. Such a comment is not enough to notify the County of a potential legal problem. Therefore, the Sierra Club failed to exhaust its administrative remedies with respect to this issue. (*Temecula Bank of Luiseno Mission Indians v. Rancho Cal. Water Dist.*, *supra*, 43 Cal.App.4th at 434.)

DISPOSITION

The judgment is reversed with directions to the trial court to enter a judgment granting in its entirety the Sierra Club's petition for a writ of mandate. Appellant to recover costs on appeal.

O'ROURKE, J.

WE CONCUR:

NARES, Acting P. J.

HALLER, J.

IMPERIAL COUNTY
PLANNING & DEVELOPMENT SERVICES
PLANNING / BUILDING INSPECTION / ECONOMIC DEVELOPMENT / PLANNING COMMISSION / ALUC

JURG HEUBERGER, AICP CEP,CRO
PLANNING & DEVELOPMENT SERVICES DIRECTOR

March 8, 2006

United States Gypsum Company (USG)
Attention: Mr. Huss, Plant Manager
P.O. Box 2450
El Centro, CA 92243

Re: Registration of wells and water pipeline per Imperial County Groundwater Ordinance Sections 92103 & 92204
APN: 033-380-44-01 & 033-380-47-01

Mr. Huss:

On March 14, 2005, USG submitted to the Planning & Development Services Department four forms to register for "historical county uses" those for the existing water wells used to extract groundwater and one for the waterline used to transport water to the Plaster City plant. After reviewing these registration forms and all the evidence before it, the Planning & Development Services Director has approved the historic county use registration for the three wells and the pipeline, subject to the attached terms.

In the event USG increases the water extraction above the 767 acre-feet per year limit for these three water wells, an application for a Conditional Use Permit with approval by the Planning Commission and/or Board of Supervisors is necessary.

If you have any questions regarding this matter, please feel free to contact me at (760) 482-4236 extension 4310 or by e-mail jurgheuberger@imperialcounty.net

Sincerely,

JURG HEUBERGER, AICP CEP
Planning & Development Services Director

Attachments:
A. Terms

CC: County Counsel
Daniel Sackett, Assistant Planning & Development Services Director
File 10.00, 10.01, 10.02, 10.03, 10.05
File 033-380-47-01, 033-380-44-01

MAIN OFFICE: 801 Main St., El Centro, CA 92243 (760) 482-4236 FAX: (760) 353-8346 E-MAIL: planning@imperialcounty.net
EL CENTRO OFFICE: 836 Main St., El Centro, CA 92243 (760) 482-4400 FAX: (760) 337-8467 WEB SITE: www.imperialcounty.net/planning

SPECIFIC TERMS FOR GROUND WATER WELL REGISTATION

APN: 033-380-44-01 & 033-380-47-01 for water wells & water pipeline

T-1 Any new well or existing well that is not under an Imperial County conditional use permit shall be registered with Planning & Development Services Department and the state pursuant to California Water Code Section 13751. **(Pursuant to Title 9, Division 21; Registration of Well Section 92103.00)**

T-2 Registration of 767 acre-feet (AC FT) of groundwater per year is the maximum amount of groundwater extraction & exportation allowed for the combined wells #16S/9E-36C1, 16S/9E-36C2, 16S/9E-36C3, (684,733 gallons per day/4,805,302 per week, based on 7 days per week/ 52 weeks per year calculation).

T-3 A flow meter shall be installed and sealed by a California state licensed water well drilling contractor. USG shall submit an annual report to the Department indicating the calendar year amount of water extracted from the wells. A photograph (dated and signed) of the flow meter readings shall be included in the annual report. The report shall be received by January 15 of each year following the issuance of this registration. In the event of a flow meter failure, USG shall immediately notify the Department, but not be required to cease the water well operation, **so long as the main plant water flow meter remains in operation**. USG shall fix or replace any flow meter that fails within 2 weeks. USG may be allowed to temporarily substitute the flow meter for an alternative measuring device, at the approval of the Department. In this case two (2) separate reports shall be submitted as stipulated herein **(Pursuant to Title 9, Division 22; Groundwater Ordinance 92202.04 Extraction Facility Water Flow Measurements**

T-4 Should a water well be "abandoned" at any time, USG shall seal/cap the well according to standards set by the state and in a manner acceptable to the County Building Official. "Abandoned" for purposes of this registration:

"Means the cessation or suspension of use of a facility for more than twelve (12) consecutive months, or such longer period of not more than twenty-four consecutive months as the director may approve in writing." USG may have a well deemed inactive by filing a written notice with the Department stating its intentions to use the well under specific conditions or time frames. Any well that is open or whose services/operating equipment (e.g. pumps/motors/pipes etc.) has been removed shall be deemed abandoned. In all instances of abandonment, USG shall comply with the state and local laws governing well closures and deactivation.

T-5 Any abandoned well shall be destroyed according to state standards and in a manner acceptable to the county building official. A copy of the well driller's report by a California state licensed water well drilling contractor shall be sent to the Department of Public Works and the Department within thirty days following the destruction of the water well.

T-6 An encroachment permit shall be secured from the Department of Public Works for any and all new or altered driveways to access the property.

T-7 The County reserves the right to enter the premises to make the appropriate inspections and to determine compliance with the terms of this registration. Access to authorized enforcement agency personnel shall not be denied.

T-8 Registered owner of wells # 16S/9E-36C1, 16S/9E-36C2, 16S/9E-36C3, shall defend, indemnify and hold harmless County and its agents, including consultants, officers and employees from any claim, action or proceeding against the County or its agents, including consultants, officers or employees to attack, set aside, void, or annul the registration of these wells and the accompanying pipeline. This indemnification obligation shall include, but not be limited to, damages, costs, expenses, attorney's fees, or expert witness costs that may be asserted by any person or entity, including any claim for private attorney general fees claimed by or awarded to any party from the County.

T-9 In the event of a dispute the meaning(s) or the intent of any word(s), phrase(s) and/or conditions or sections herein shall be determined by the Planning Commission of the County of Imperial. Its determination shall be final unless an appeal is made to the Board of Supervisors within ten (10) days from the date of the Commission's decision.

T-10 Should any condition(s) of this registration be determined by a Court of other agency with property jurisdiction to be invalid for any reason, such determination shall not invalidate the remaining provision(s) of this registration.

T-11 A registered "historic county well user" may increase extraction of existing, registered wells only by applying for and receiving a discretionary conditional use permit from the County of Imperial.

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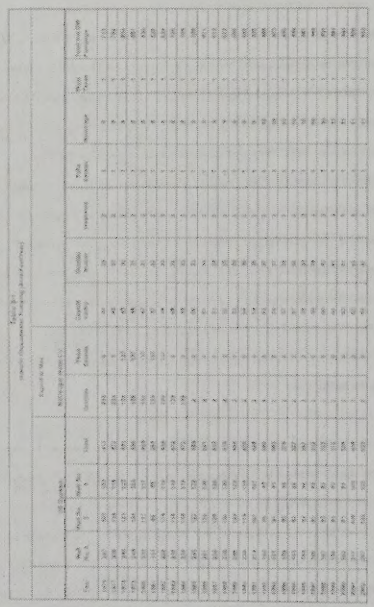


Table 4-3
Historical U. S. Gypsum Well Production

Year	Well Production (Ac-ft/y)
1976	410
1977	472
1978	481
1979	496
1980	469
1981	261
1982	456
1983	472
1984	472
1985	488
1986	321
1987	312
1988	519
1989	492
1990	476
1991	428
1992	388
1993	368
1994	379
1995	377
1996	367
1997	355
1998	333
1999	372
2000	394
2001	434
2002	339

Sand and Gravel Operations

The 1998 Ocotillo/Nomirage Community Area Plan (ONCAP) identifies Vail Rock and Farmers Land Leveling as water users of 6 and 8 acre-feet per year, respectively. Several other sand and gravel operations are located throughout the area, including Caltrans, Imperial County Public Works and Cluette Construction. However, no estimates of water use were presented in the ONCAP for these operations.

4-3

NOTES:

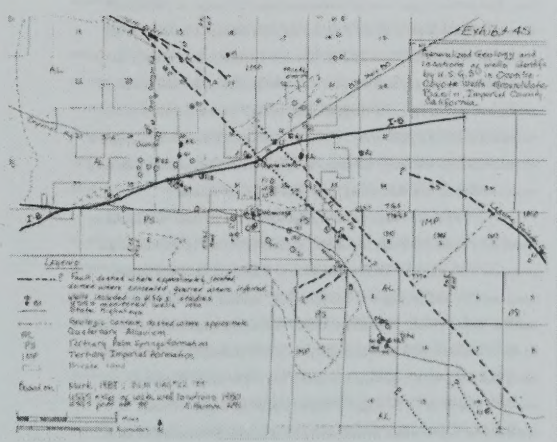
** "A second dwelling may be allowed upon approval of a conditional use permit." Desert Residential (ONCAP p. 14) and Low Density Residential (ONCAP p. 15)
"A second dwelling may be allowed upon approval of a conditional use permit if the lot meets size requirements for septic systems." (Residential (ONCAP p. 15)

a. The number of units is an estimate for the entire 875 acres. Many lots in units 1, 2, and 3 are located within the FEMA floodway, where new construction is very uncertain. Water usage includes estimate for RV parks and commercial usage. 366 dwellings in 1990 within ONCAP.
b. Number of RV spaces and water usage is uncertain, included within the figure for Ocotillo ONCAP 4/26/94 approval allows for an unspecified number of additional RV spaces. Supervisor Monies wanted to see 150 RV spaces approved, more spaces means more water used.
c. 154 Ac of desert residential (40 ac lots) in first draft was changed to low density residential (5 Ac min lot size) by BOS on 4/26/94 at request of owners
d. ONCAP provides no limitation on water usage for industrial usage because US Gypsum export is the largest industrial use of groundwater.
e. 7.6 Ac of desert residential was changed to commercial by BOS 4/26/94 at request of Twyman's attorney.
f. Pumpage is for two gravel companies in 1994. future estimates are uncertain.
g. Further reports estimated US Gypsum pumpage at 600 AF/Y. ONCAP states USG reported 339 AF/Y in 1992. 4-6b USG DEIR at p. 2.0-17 states 1998 USG water usage at approximately 300 AF/Y. USG DEIR Vol II Appendix B 2 the Bookman Edmonston 2004 (BE04) groundwater study done for US Gypsum states that water well production by USG in 1998 was 333 AF/Y. (4-6b USG DEIR vol. II Appendix B-2, BE04 Table 4-2 p. 4-2.3. Why doesn't USG DEIR vol. I use same facts as convenient USG have?

Table 6 Hypothetical Water Budgets for Build-out of Ocotillo-Nomirage Community Area
consistent with the acreages, land use designations , density and water use permitted by the Ocotillo-Nomirage Community Area Plan adopted by the Board of Supervisors 4/26/96 as part of the Land Use Element of the Imperial County General Plan.

ONCAP "Objective 5.10 Impose a limit of 1.5 acre feet of water per dwelling unit in the Ocotillo/ Nomirage Community Area."

ONCAP area acres and or # lots at build-out projected by ONCAP 1994	Water use acre feet/year (AF/Y) at build-out per ONCAP 1994	
	1.5 AF/unit or lot/Y at 100%/lot	1.5 AF/unit or lot/Y at 200%/lot **
Ocotillo 573 Ac, (0.5 AC min lot size)	450	900 (a)
Unit 1 80 lots		
Unit 2 125 lots		
Unit 3 92 lots		
Ocotillo RV 12 spaces		
Ocotillo motel/RV 16 spaces		
RST 60 Acres		(b)
NoMirage 96 lots	144	288
Yuha Estates 16 lots	16	48
Davies Valley 36 lots	54	108
385 Ac (5 Ac min) 77 lots	135	330
154 Ac (5 Ac min) 30 lots	45	90 (c)
S 2 jct S 98 4 lots	6	12
12,386 Ac (40 Ac min.) 309 lots (3rd draft ONCAP)		
12,225 Ac (40 Ac min.) 305 lots 4/26/94 BOS approved ONCAP)	457	914 (c)
Commercial/industrial	50	50 (d)
Inkopah 123 Ac		
S of Ocotillo Industrial 6 Ac	30	30 (e)
S 2 near Hwy 98 7.6 Ac		
Sand and Gravel Companies (2 wells)	14	28 (f)
TOTAL AF/Y without US Gypsum export	**1341**	**2675**
US Gypsum 1998 pumpage projected (used 333 AF in'98, BE04 Table 4-2)	767	767 (g)
TOTAL AF/Y with US Gypsum export	**2128**	**3442**



Properly Interpreting the Epidemiologic Evidence about the Health Effects of Industrial Wind Turbines on Nearby Residents

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Abstract

There is overwhelming evidence that wind turbines cause serious health problems in nearby residents, usually stress-disorder type diseases, at a nontrivial rate. The bulk of the evidence takes the form of thousands of adverse event reports. There is also a small amount of systematically-gathered data. The adverse event reports provide compelling evidence of the seriousness of the problems and of causation in this case because of their volume, the ease of observing exposure and outcome incidence, and case-crossover data. Proponents of turbines have sought to deny these problems by making a collection of contradictory claims including that the evidence does not "count", the outcomes are not "real" diseases, the outcomes are the victims' own fault, and that acoustical models cannot explain why there are health problems so the problems must not exist. These claims appeared to have swayed many non-expert observers, though they are easily debunked. Moreover, though the failure of models to explain the observed problems does not deny the problems, it does mean that we do not know what, other than kilometers of distance, could sufficiently mitigate the effects. There has been no policy analysis that justifies imposing these effects on local residents. The attempts to deny the evidence cannot be seen as honest scientific disagreement, and represent either gross incompetence or intentional bias.

1 Introduction

There is overwhelming evidence that large electricity-generating wind turbines (hereafter: turbines) cause serious health problems in a nontrivial fraction of residents living near them. These turbines produce noise in the audible and non-audible ranges, as well as optical flickering, and many people living near them have reported a collection of health effects that appear to be manifestations of a chronic stress reaction or something similar. However, many commentators (dominated by those who stand to profit from national government subsidies for building wind turbines, particularly energy companies and local governments) have repeatedly claimed that there is no evidence of risk. This appears to be widely believed by those unfamiliar with the evidence but who believe that turbines are an eco-friendly energy source (a claim that is subject to debate) and think that anything "green" must be harmless to people.

While it is typical for industries and their supporters to downplay risks and argue that the benefits make the risks worthwhile, the wholesale denial of the evidence by both business and government in this case is reminiscent of such claims as "there is no evidence that smoking causes cancer" or "Iraq has weapons of mass destruction". However, unlike most industry denials or *casus belli*, where critical thinkers know to exercise some skepticism before accepting the claim, the denial of the evidence of turbines seems to have produced widespread credulity among those who would be expected to know better. This may be because the epidemiologic evidence is complicated and the attempts to deny it sound like the language of science. In response to that abuse of science, the goal of this paper is to empower interested observers to understand the nature and quality of the epidemiologic evidence and the weakness of the common arguments used in attempts to deny it.

It is argued here that there is ample evidence that turbines cause a constellation of health problems, and attempts to deny this involve claims that are contrary to proper methods of scientific inference. Moreover, there is no basis for claiming that current regulations and recommendations are sufficient to avoid substantial risk, and those who claim otherwise do so without any basis. Indeed, ironically, what is often presented as evidence that there are no risks shows no such thing, but does demonstrate that most claims about what constitutes sufficient regulation cannot be scientifically. Moreover, the balance of the necessary ethical analysis seems never to have been performed. Given these observations and consideration of public policy ethics, it is difficult to see how most of the ongoing siting of new turbines can be justified.

A brief review of the epidemiologic evidence

For those not familiar with the term, epidemiology refers to the study of health outcomes and exposures in people for purposes of making assessments about population health. The critical feature is the studying of actual health outcomes in actual people, as opposed to other sciences (like toxicology or, most relevant in the present case, acoustics) which might help predict health outcomes but can be quite wrong about them. Those other sciences sometimes suggest possible effects that the epidemiology shows do not actually occur to a measurable degree and other times fail to predict the health effects that really do occur. Epidemiology is a quantitative science, though the quantification ("effect estimates") that is the preferred endpoint for most epidemiologic research is not always possible, as in the present case. Most, but not all epidemiology focuses on whether a particular *exposure* (possible cause experienced by people) causes a disease outcome. While epidemiology often depends on observational evidence,

sometimes experiments can be done; clinical trials are the most familiar, but a different kind of experiment has been done in the case of turbines.

There are many different types of evidence that contribute to epidemiologic knowledge. While the majority of formal epidemiologic studies use only three or four study designs, there are numerous other types of studies and sources of information. As with any science, when engaging in a directed inquiry to answer a particular question, one uses what information is available and purpose-builds further information-gathering, and often such information and study design differs from the most common study types. Indeed, in the present case some information is available from the common study types, but the vast majority comes from other sources, particularly *adverse event reports* (a particular type of what are known as case studies, sometimes denigrated as "anecdotes", that generally report on the rapid onset of a disease which appears to be related to a particular exposure) many of which involve case-crossover experiments. Both of these are useful and well accepted sources of epidemiologic information, and since they are intuitively recognized by both experts and lay-people seeking to assess whether an exposure is causing disease outcomes, people have collected this information for years (though it is not clear that anyone working in the area had identified the established terminology and it established history in the science value before I pointed them out last year).

Large collection of evidence

Most of the adverse event reports are self-published by those concerned about the health effects experienced by themselves or family members in the interest of contributing to public health knowledge on the subject. Most of these are yet to be organized, although efforts are underway. Others have been collected more systematically, such as the WindVOiCe collection

from Ontario (Krogh et al. 2011), the scholarly book by Pierpont (2009), and in a paper by Harry (2007). Since several research groups and NGOs have collections that number in the three-figure range, it seems safe to conclude that the total number published or collected in some form is in the four-figure range, and it is quite conceivable that the total number of adverse event reports numbers in five figures.

Excerpts from three of those from my research group's collection appear in the Appendix to illustrate some of the points that follow. These three were self-published by the authors on the web and are fairly typical, though they were chosen because they were good examples, not because they are somehow perfectly representative of the collection. The reports have been abridged to remove information not presently relevant, and to reduce length.

In cases of emerging and unpredictable disease risk, adverse event reports are the cornerstone of public health research. Since it is obviously not possible to study every possible exposure-disease combination using more formalized study methods, just in case an association is stumbled upon, collecting reports of disease cases apparently attributable to a particular exposure is the critical first step. The most familiar examples of hazards revealed by adverse event reporting are infectious disease outbreaks or side effects from pharmaceuticals, but the case of turbines and health also fits the pattern. Pharmaceutical regulators rely heavily on clearinghouses they create for adverse event reporting about drug side effects (and often become actively concerned and even implement policy interventions based on tens of reports). The WindVOiCe report collection is an example of this same well-accepted kind of active-recruiting data collection system.

As explained in the next few sections, useful self-reporting of adverse events is only possible for particular types of exposures and outcomes, but exposure to turbines and many of the reported health effects are just those types of exposures and outcomes.

Reasons the adverse event reports are compelling

Adverse event reports are under-appreciated as a source of evidence. The main reason for this seems to be overgeneralization from cases where they are indeed uninformative by those who do not understand what characteristics exposures and outcomes must have for them to be informative. It is always possible to find a single case study of an exposure-disease combination because even if there is no relationship between an exposure and a disease, it is statistically inevitable that someone will have both by coincidence. Thus, when political activists dig up a story about one such individual ("here is someone who had that exposure, and look what happened to him!"), we should be skeptical. This is especially true when the disease in question occurs frequently in the population and it is not possible to simply "see" the exposure that triggered it, like common cancers or heart disease. Many people get those diseases (and thus it is not difficult to find a few examples), the exposures that trigger them are invisible, and we cannot identify the onset to associate it with a proximate exposure. The challenge is greater still when the exposure itself is vague and difficult to precisely define, like "lived near the chemical factory". In such cases, it is nearly impossible to learn much from reports of adverse events, and indeed claims about a particular cause of one person's case of the disease can almost never be justified, and so more systematic studies are needed.

The reports about the effects of turbines are not such a case. The sheer volume of reports elevates the evidence beyond the few coincidental cases that can usually be found. The quantity

further tells us that the effects go beyond a few rare individuals who are extremely susceptible. It is a legitimate limitation of adverse event reporting, no matter how voluminous, that it does not allow an estimate of what portion of the exposed population suffers health effects. There are undoubtedly similar effects among those who have not made the effort to publish the information, but we can only guess how common they are. It should be noted, however, that pharmaceutical regulators often make decisions based on exactly that guess.

Moreover, most reported health problems are similar across reports and are plausibly related to each other and the exposure. As illustrated by the examples in the appendix, there is a core list of symptoms – sleep disorders, headaches, mood disorders, inability to concentrate, tinnitus, vestibular (balance) problems – appearing in most reports. The commonly reported problems all exist at the border of the psychological and physical, and can all be caused by either of two very plausible effects of wind turbine exposure: stress reactions or vestibular disturbance. There are also a few reports of hypertension and other mortality-causing conditions, though since this is difficult for individuals to monitor themselves it would be unlikely to appear in most adverse event reports.

The Appendix examples also illustrate that some people attribute various other conditions they are experiencing to the turbines; this is not surprising, but the volume of reports lets us sort out rare coincidences (which can indeed generate misleading "anecdotal evidence" if a single story is treated as overly informative) from common patterns. We need not, and should not, simply accept the assertion of one individual or their clinicians about causation, assertions which appear in most of the adverse event reports. Rather, we focus on the consistent patterns of diseases that occur after exposure onset. (It is possible that mining the case reports more thoroughly will reveal apparent associations to diseases that were not previously believed to have

been caused by turbines; such research is ongoing.) If people were complaining only about a collection of seemingly unrelated ailments, without the core overlap, it would suggest that they were just blaming the turbines for all their coincidental problems. But that is clearly not the pattern that emerges.

Most important, in contrast with exposures like invisible chemicals and diseases like cancer, individuals are capable of recognizing both the exposure and outcomes. Local residents are quite capable of observing that they are detecting noise or other effects. Moreover, people are capable of detecting their own insomnia, mood disorders, inability to concentrate, etc. Even more importantly, they are capable of detecting the *incidence* (i.e., onset) of these problems as well as when they cease, and while these problems are fairly prevalent in the population at any given time, their incidence is relatively uncommon and very often has a proximate cause.

For a relatively common condition, if we only had *prevalence* measures (i.e., how many people have the condition at any point in time), then in order to conclude that those living near turbines have a higher rate of the condition we would want to compare their rates to that of similar people not living near turbines. Similarly, if we were talking about cancer (where epidemiologists refer to the diagnosis as the incidence for convenience, but actually have no idea when the cancer initially began growing) we would want such a comparison. But for something that is very rare (e.g., not *having* a pattern of severe insomnia, which is not rare, but having that pattern *start a particular week*, which is) we can conclude the incidence rate is elevated without an explicit comparison. For example, many people have headaches at any given time, but if you have one that started at the time you suffered a trauma there is a good chance the trauma caused it because the probability of a headache starting at just that minute by coincidence is very low. Thus, people are quite capable of determining that incidence of these health problems occurs

after exposure to moving wind turbines begins, unlike claims about what caused a particular cancer where such observations are not possible. Some supposed experts who have merely memorized a few simplistic rules of thumb from first-year epidemiology classes are unlikely to understand this, but the knowledge of that incidence and its timing is compelling evidence of causation even without a formal comparison group.

The above observations alone show that the adverse event reports are strong evidence for a causal relationship. The fact that many of the published adverse event reports include case-crossover observations and experiments push the evidence beyond a hint of plausible doubt.

A case-crossover study is one of the most compelling sources of epidemiologic data. It consists of observing whether someone's outcomes change as their exposure status changes. This is often not possible because the outcomes only happen a single time as a result of long-term exposure (e.g., cancer) or the exposure cannot be changed. But the observed effects of turbine exposure lend themselves perfectly to such studies because the exposure is transient and the effects, while not instantaneous in their manifestation or dissipation, are generally transient over a period of days or weeks at most. Thus, unlike a case of a lifelong exposure or non-transient disease, where we can only make one observation about disease and outcome per person, the effects of turbines allow multiple observations by the same person, including experimental interventions.

The case-crossover study design was first formally documented as a method for epidemiologic inquiry by Maclure (1991) though undoubtedly it was recognized as extremely useful for drawing conclusions about health effects from before the time our ancient ancestors achieved the rank of *H sapiens*. A case-crossover study is the most natural form of scientific inquiry: "I ate that and my stomach hurt; I did not eat it again for a while and had no problem; I

ate it again and my stomach hurt again; I think I there is a causal relationship here". This natural understanding of scientific inference is why such a large portion of the adverse event reports include crossover data. People observe, and report, that the exposure stops when the wind is not blowing or the subjects remove themselves from the area for a while, or especially when they relocate, and they observe whether the health problems abate. Some of these crossovers are observational (the change in exposure status was unplanned) but many are experimental (people intentionally avoid the exposure for a while to see if their health problems abate). Most of the reported crossover data confirms the causal inference that comes from the initial crossover from unexposed to exposed, the start of operations of the nearby turbines, which would be the only observation possible if it were impossible for exposure status to change again (as it is with such exposures as "ever smoked", "received a high dose of radiation", or "got older"). The examples in the Appendix include several of the common versions of crossover data, including complete relief upon relocating, the ability to sleep well when staying somewhere other than the subject's own home, and reactions to whether the wind was blowing through the turbines at any given moment.

An additional feature of the data in this case is *revealed preference* information about individuals' conviction regarding the causal relationship and intensity of costs inflicted upon them. Many people report expending substantial resources – retrofitting their houses to reduce noise, selling their properties at a loss, or even abandoning their homes without being able to sell them – in order to try to reduce the health impacts. (The Appendix includes examples of such revealed preference.) Thus, rather than just claiming they were confident about the causal relationship (perhaps thanks to personal case-crossover experiments) and describing the intensity of their suffering, they "put their money where their mouth is" and endure great expenditure,

demonstrating great confidence in their assessment and that the magnitude of the suffering warrants such expenditure. Similar revealed preference can be found in the inability of owners of property near turbines to be able to sell it at a price comparable to other homes or land that is not near turbines. It is sometimes claimed that few people believe there are harmful effects or that they would experience them if they lived near turbines, but property values and sales collapse only if almost everyone is uninterested in living there. If merely a few people believed the claims that there were no problems, and were willing to intentionally relocate to live near turbines, then they would take advantage of the bargains and move in; alternatively, speculators – perhaps the energy companies or local turbine proponents – would snap up the bargains. This is apparently not happening, suggesting that no substantial number of people, even those making the claims, genuinely believe that the turbines are harmless.

In sum, the present situation lends itself perfectly to having useful adverse event data, in terms of exposure and outcome that are easily identified, incidence times that are easily identified, the possibility of case-crossover data, and the possibility of revealed preference. The empirical reality is that we have an enormous volume of data, the outcomes reported are plausibly related, many people have performed case-crossover experiments that support the conclusions, and there is indeed revealed preference data.

This still leaves the inherent limitations of this type of non-systematically gathered data: Because the data does not have known sampling properties from a well-defined population, it does not itself tell us how many others might have reported adverse events had they experienced them, but did not. This information is the denominator that would be required to calculate the portion of all exposed people who experienced the adverse events. We have some information that lends itself to estimating that figure, from a handful of systematic studies and using

estimates from where there was a focused effort to collect all local adverse event reports, but not as much as we would like. The data we have also offers limited opportunity to estimate how much the risk changes with characteristics (in particular, that means we do not know how far away turbines need to be from residences to reduce the risk below some particular level).

Nevertheless, in terms of demonstrating that there is a substantial risk of serious health problems, the adverse event reports are more compelling than any small number of systematic studies could be. Moreover, the sheer volume of data makes it possible to mine it for some information that is normally only available from systematic studies, like the effectiveness of crossovers at eliminating the health problems and the dose (distance) response; such mining is underway.

Systematic epidemiologic evidence

While not providing us much information as the adverse event reports, the few systematic studies (with data gathered from a defined population, allowing calculation of outcome prevalence), offer the reassurance that different sources of information support the same conclusions.

There is a small collection of systematic studies from Europe by Pedersen and colleagues (2004, 2007, 2009, 2010). These studies suggest that some substantial portion of exposed individuals experience harms, some of which constitute health problems by any modern definitions of health. The studies have various limitations, but they provide a quantification of a nontrivial number of cases. Phipps (2007) also tends to support the claim. Nissenbaum et al. (2011: personal communication) was the most effectively purpose-built study to date. It surveyed residents living near turbines about most of the above-mentioned health conditions and

compared them to similar people living further away. The results (unpublished at the time of this writing) appear to support most of the widely-stated hypotheses about the health effects of nearby turbines. Importantly, there do not appear to be any systematic studies whose results suggest conclusions contrary to those we draw from the adverse event reports. In particular, there is no evidence to support the claim that the relevant health problems are similar in unexposed and exposed populations.

Attempts to deny the epidemiologic evidence, and their fundamental flaws

Because of the revenue that is at stake from government subsidies to wind power producers (including to land owners and local governments), there are wealthy organized interests who would prefer everyone doubt that the observed health problems exist. There also appears to be some "not invented here syndrome", with some acousticians and clinicians resenting the fact that they cannot explain the observed health problems, and thus seeking to deny the epidemiology. Whatever the motivation, there has been a pattern of anti-scientific claims aimed at denying the evidence. While there is individual variation, a pattern has emerged within the denial tactics (and that word choice is intentional; it is difficult to see these as anything other than directed efforts to secure a particular goal). The following divides these into three categories and explains why each of the common arguments is groundless. While this does not cover every single argument anyone makes, it is comprehensive in the sense that I am aware of no common or potentially-credible argument against the validity of the epidemiologic evidence that is not addressed here.

1. Pretending that there is no evidence of health effects

Many pro-turbine reports sponsored by industry or government simply ignore all of the adverse event reports. Any reader limiting himself to those supposed summaries of the evidence would not even be aware of the majority of the evidence. Obviously this is blatantly anti-scientific conduct. It is perfectly legitimate to argue that the ostensible evidence against your claim is uninformative or wrong, but anyone pretending it does not exist is attempting to mislead their readers and is presumably not confident their claims can stand up to the evidence.

When turbine proponents acknowledge the evidence and seek to deny its usefulness, they are more honest, but no more convincing. Many such denials translate roughly into, "we do not recognize the informative value of adverse event reporting and case-crossover studies, and therefore we are going to declare they are not informative." In practice this differs little from simply pretending there is no information – no one ever admits, "there are thousands of case studies that report crossover data that correspond to the causal claim", before going on to argue that we should not believe them. But it bears separate mention because it is common, particularly among the epidemiologists from consulting firms that industry likes to hire. Their claims are not merely that some types of evidence are more useful than others when answering a particular question (which is true) or that there is some rigid epistemic hierarchy wherein one type of study always trumps another (which is false, but is commonly believed by non-experts who know a bit about the subject), but sometimes that there are only two types of epidemiologic studies.

These authors' limited understanding of epidemiologic methods may stem from the fact that most of their work is defending against claims of cancer and other diseases that have the characteristics described above, where it is difficult (but not impossible) to learn much from anything other than one of those two types of studies. What they do not seem to understand is

that exposures and diseases are often not epistemically similar to chemical exposures and cancers. The evidence that is most useful depends on the question being asked. (For more on these points and others in this section about how to interpret epidemiologic evidence, see Phillips 2011.)

So, to pick a recent example, if many people gathered in a North African city started sending out messages that government forces are shooting into the crowd, it is very good evidence that shooting is happening. Yes, we could do a controlled study to find out if the number of gunshot wounds treated at hospitals was higher that day than the same day the year before. But it is possible that such a study could miss the effect – it could sample from the wrong hospitals, or the government could act to suppress the information, or the study could suffer from any number of problems. It is true that some systematic survey, rather than individual reports, would be necessary to quantify the toll. But the event reports coming from eyewitnesses would be the most definitive source that the event was occurring, and if they were provided in enough detail by enough people they would be systematic enough to be the best way to estimate the toll. To claim that we know nothing about those events until we have multiple systematic studies (what some turbine industry proponents have argued) requires a willful suppression of normal human reasoning. This example is not meant to be a cartoon; it is actually a reasonable analogy. In terms of witnesses' ability to detect the exposure and outcome and the potential limitations of more systematic studies, turbines are much more similar to gunfire than they are to the effects we normally attribute to noxious facilities.

The other common method for trying to claim that the adverse event reports are not informative (again, typically coupled with trying to imply there are only handful of them, failing to acknowledge the quantity) is to note that they are not "peer reviewed". It seems likely that

most people repeating this claim do not even understand what peer review does; if this is not the case then they are pretending not to understand. At its best, peer review by health science journals provides a cursory review to make sure that a study follows some basic guidelines, and occasionally (very rarely) corrects an important error. Reviewers rarely comment on the quality of analysis methods, let alone the data being analyzed, because they do not even provided with the statistical programs or data. Reviewers see nothing more than what eventually appears in the journal, which almost never allows the reader to know critical features of the study design, let alone assess whether they were carried out adequately. And that is the best case scenario; more typically peer review in the health science does more to censor politically incorrect evidence and discourage innovation than it does to improve what is published. It is easy to get an absolutely terrible study published, so long as the authors jump through particular hoops, stick to simple methods, and do not reach a conclusion that is controversial (the conclusion need not follow from the data, however). It is quite difficult to publish a high-quality innovative study that engages if more complex analysis or demonstrates something new – e.g., the present analysis or WindVOiCe. Moreover, peer review has drifted from being a minimal but useful gatekeeper to primarily being a method for university employees to keep score for their annual reviews.

That is all it is, and treating it as more fetishizes it, in both of the technical senses of the word: It is treated as some kind of magical process, and it has become a stand-in for the phenomenon (good and accurate research whose essential elements have been assessed and improved by multiple experts) that it is supposed to represent. While it may be necessary for casual readers with absolutely no expertise in a field to defer to rules of thumb like "only look at the peer reviewed literature and 'expert' reports" to avoid falling victim to the worst quackery, that merely means that it provides some filtering, not that the rule is a useful guide for serious

scientific inquiry. A debating society or a grade school term paper needs rules to structure the artificial exercise, and so can just as easily choose "peer reviewed references only" as any other rule. There are also arguments to be made for (and against) the use such rules of evidence in liability trials and other formal processes that need some rules of conduct. But there is no justification for legalistic rules of evidence when engaging in scientific inquiry and its extension, science-informed policy making.

Moreover, even though value may be added from peer review of the best kind (which usually takes the form of circulating a paper among colleagues, not relying on the triage system of the journals to add much value), no peer review can vouch for the accuracy of data without actually reviewing the data collection method. This means that adverse event reports, which consist of someone reporting their data as best they can (we can ignore the authors' own analyses and conclusions and focus just on the events data), would not be improved by peer review. That is not to say that the adverse event reports will never be represented in the peer reviewed literature, they will almost certainly become the data for analyses in journal articles, but will not be rendered any more accurate as a result of that.

Indeed, eventually most of the useful information on a topic is referenced somewhere in journal articles, and at that point relying only on those articles alone does not cost us too much information, but we are currently far from that point for this topic. For supposed experts, acting as consultants or otherwise writing "expert" reports, the fetishization of peer reviewed literature is basically a concession by the authors that they are not really experts in either the relevant scientific methods, the subject matter, or both. Actual experts are the ones who can look at something and assess its usefulness; after all, being an expert means being capable of performing the peer review rather than relying on someone else's assertions.

Moreover, until there is a sufficient body of literature, the adverse event reports will continue to be more compelling than the formal studies. Anyone who is familiar with epidemiology knows that it is easy to design a study that, as reported in the cursory description of methods that peer reviewers ever see, reads like it is solid and would detect the phenomenon of interest if it exists, but is actually almost guaranteed to find nothing. Consider how easy it would be to conduct the study, "I searched the apartment for my keys but did not find them", in a way that would likely fail even if the keys were in your apartment (e.g., search for only five seconds; search the neighbor's apartment instead of your own; keep your eyes closed; put the keys in your back pocket before you start). Designing a study to fail to find a health effect from turbines would be equally easy, and it is actually a bit surprising that the industry has not done this already.

It is also quite possible to design a study that is likely to "detect" a phenomenon that does not exist. This is a bit trickier than intentionally finding nothing, and sometimes requires detectable subterfuge like defining-down the phenomenon studied to something common and unimportant but then reporting the result as if it were dramatic (e.g., asking "have you ever noticed turbine noise while trying to fall asleep" and then reporting "our results show turbines cause sleep disorders"). Setting aside the details and the direction of likely bias, the general lesson is that in an advocacy situation, opaquely complex studies of the type published in health science journals can easily be gamed by a researcher without even violating the rather weak norms in the field, while gaming thousands of adverse event reports would require massive fraud.

Finally, it can be argued that those who seek to deny the evidence are making an implicit promise to believe the evidence of health effects as soon as it appears in peer reviewed journals,

and they should be reminded of that implicit promise in the future. Most people reading this paper will do so after it has the imprimatur of "peer reviewed publication". That means that the adverse event reports contained in the Appendix are peer-reviewed journal publications. Does that make them any more valid than when originally published by the author? Of course not. The reviewers had no way to assess the accuracy of the report, just as reviewers of health science papers can never vouch for the accuracy of the data that underlies an analysis. But those who protest that lack of peer review is the reason for not believing much of the evidence are now obliged to accept the report in the appendix as fact.

2. Trying to claim that theory and historical guesses outweigh the evidence

If no one could figure out any way that turbines could possibly affect people's health then we would have reason to seriously question whether the epidemiology was correct. But we know that noise and light effects from turbines impact people's senses and otherwise affect their bodies, and so there is a plausible causal pathway from the turbines to diseases. Furthermore, we know that some of the impacts create distressing awareness which causes stress reactions, which might or might not explain many of the observed health problems, but it plausibly could explain them. There are also more complex theories about pathways that are the subject of debate by those who are expert in the biophysics.

Thus, it is not yet clear which of the hypothesized pathways play a significant role in health effects. But it is clear, given the list of plausible candidate pathways, that there is no legitimate basis for claiming it is impossible for turbines to cause health effects. Yet that is exactly what some commentators have claimed. Generally this takes the form of someone proposing one pathway by which noise might cause health problems, probably the one he has

studied, and offering a single model for assessing whether the outcome is likely to occur. When his model cannot explain the problems, he concludes that there are no problems.

The flaw in this reasoning should be obvious, though it is remarkable how convincing some people apparently find it. Sciences like toxicology and, in this case, acoustics can help predict whether an exposure might cause a health problem before we have actually observed whether it does so. But the epidemiology trumps the predictive evidence. Acoustics and other science still have an important role to play in helping figure out *why* the turbines are causing health effects, but their role as predictive sciences is over: we now have epidemiologic results which the other sciences apparently failed to predict. Continuing to rely on predictions about whether the exposure might cause disease once we have seen that it does cause it is like trying to figure out whether it is raining right now by looking at last week's weather forecast for today.

A particular observation takes the form of claims like, "there are health effects associated with living near a turbine, but the physical sciences show there are no *direct* effects." These assertions about "no direct effects" are presented as if the phrase has some scientific meaning, and thus the reader should be impressed. But anyone with expertise in studying causation will realize that the statement is vacuous because there is no such construct as "direct effect". It is always possible to insert an intermediate step in between two points in a causal pathway, or remove all the intermediates from consideration, and thus it means nothing to call an effect either direct or indirect. Moreover, though this is generally a component of strained arguments that are attempting to deny the evidence, it should be recognized that those making this claim are saying "the physical effects caused by the turbines impact people's bodies, but it is only when some biological or psychological process is caused by that impact that the diseases we observed are then caused". That admission that the turbines are causing health problems is certainly an

accurate statement, just as it is accurate to say that cigarettes do not "directly" cause lung cancer because the cancer only happens when their impact on the body, interacting with other factors, triggers a complicated biological process that eventually causes a tumor.

There is one key lesson we can take from the inability of the physical modelers to agree about why the health outcomes occur, and the fact that there are steps in the pathway that we cannot yet be sure about: It is currently impossible to know how to change the exposure to mitigate the health effects with much confidence, other than by separating people and turbines by a great distance. The existing epidemiology does not answer this question either. Yet some proponents of turbines argue that the regulations that have been created in this state of ignorance must be sufficient to protect people. It should be obvious how absurd this claim is. Those regulations are a hodgepodge of different rules that are generally based on old recommendations that predate the recognition of the health effects and which, to the extent they were based on any science at all, were based on the science that incorrectly predicted that there would be no problem. Even if one believes that the regulations were as well thought-out as they could have been, the epidemiology shows that people suffer health effects when the regulations are adhered to.

A variation on this theme is to claim that the health problems exist only when current regulations are not met, or even when the original regulations under which the turbines are operating are violated. It is certainly reasonable to condemn operators and regulators who allow the violation of the regulations, a fairly common occurrence according to the adverse event reports. However, since those making the argument that current regulations should be adhered to do not seem to be offering such condemnation or conceding that turbines do sometimes cause health problems, it is difficult to accept their implicit assertions that adherence to current

regulations is genuinely the difference between causing health problems and not doing so. But the argument that some set of more stringent regulations is sufficient to eliminate the health problems (or that it will be obeyed) is no better supported by science than the claims that previous regulations were sufficient. Moreover, there is no shortage of aphorisms about how unwise it is to believe someone who is telling you "we were wrong, or perhaps even lied to you, about the previous regulations being sufficient, but trust us when we assert, in exactly the same way, that everything will be fine with new regulations." This is especially true when they still do not even admit that the previous regulations were insufficient.

In any case, regulatory choices and guidelines are decisions that, at best, are science-based, but offer no scientific information in themselves. It should be clear that believing last week's government decree about what the weather should be today is even less useful for figuring out whether it is raining right now than would be looking at last week's forecast. Unless, that is, we are in an Orwellian world where the language is redefined to make government decrees always correct. Some of the tactics for denying the evidence of health effects actually seem quite similar to that.

3. Claiming that the observed health effects are not really health effects

Failure to understand how to draw scientific conclusions and myopia about a single method for modeling physical health effects are problematic, obviously. But they are not so clearly reprehensible, from an ethical standpoint, as telling people that their suffering does not really "count" for some technical reason.

A common claim is that the health outcomes do not constitute a "disease" because there is no officially recognized labeled disease along the lines of "wind turbine syndrome". But even

if we set aside that the individual diseases people are suffering, like chronic stress and sleep disorders, are often well-defined (they are just not defined in terms of a specific cause), and the fact that the term "disease" is quite broad in practice, this would still only be a semantic point. There is no epistemic significance to the health outcomes in question having or not having a label.

Sometimes the denial takes the form of saying that people are just suffering "symptoms" but not a "disease", which is nonsense since in this context the word "symptoms" is shorthand for "symptoms of a disease" and, moreover, can roughly be defined as "those manifestations of a disease that are (in addition to mortality) what people actually care about". Another semantic game says that what people are suffering is not "disease" but "annoyance". The jargon used in the noise and health literature refers to effects of noise that are apparently psychologically mediated (i.e., most everything other than hearing damage) as "annoyance". The rhetorical game is to try to confuse readers into thinking this has the natural language meaning of "mere annoyance". However, the jargon meaning of annoyance includes everything from "mere annoyance" up through a life-ruining source of severe distress. Moreover, even "mere" annoyance can itself have severe health consequences when someone is forced to exist in a chronic state of annoyance.

Another somewhat common pseudo-argument is that we should dismiss the health effects because they are all "subjective". This is not actually true since, for example, insomnia can be objectively measured by looking at a clock and even long-term stress itself can be measured via hormone levels. The authors seem to be confusing "subjective" with "psychologically mediated", which most of the observed effects might well be (though there are hypotheses about non-psychological pathways).

But being subjective or psychologically mediated does not mean these effects are minor or less real. Indeed, there is a case to be made that such diseases, which include everything from transient headaches to chronic pain and depression, account for the majority of the total burden of disease in our society.

A recent addition to the rhetoric that the effects are of no consequence are assertions that effectively assert, "the problems are caused by the victims' own psychology, not the turbines." It is claimed that perhaps people fear the turbines, as people are known to irrationally fear toxic chemicals, and it is fear, not the noise or light, causing all the problems. This is a variation on the theme that was popular a year ago (though it can still be found) where it was claimed, based on one study that found a correlation between people's attitudes toward the turbines and their reported health effects, that attitudes were causing the problems. These claims sound more scientific than some of the other rhetoric, but are easily shown to be wrong.

First, the assertions themselves are rather weak. The fact that there is a relationship between suffering health effects from an exposure and disliking the exposure hardly comes as a surprise. If those who were trying to deny the evidence had read the adverse event reports, they could have found much more compelling evidence supporting this point (the feeling is apparent even in the Appendix examples despite the abridgements focusing on outcomes rather than judgments); however, in most cases it is clear that the people's dislike of the turbines was a result of their physical effects, not vice versa.

We do know that people have irrational fears of invisible hazards like radiation or "toxins", but it is difficult to imagine why someone would find a fairly simple object and exposure (metal, tower, fan blade, motor/generator mechanisms, wind, noise, flashing lights) to invoke the irrational fears that often result from invisible spooky exposures. If someone were to

try to make a plausible claim along these lines, a better case could be made that that sensitization to the serious effects of turbines is psychologically contagious; that is, once some people start to suffer serious health problems, those around them are more likely to suffer distress reactions that lead to serious health problems. This is still a speculative hypothesis, though unlike the purely speculative claims about irrational fears, one that is supported by some evidence (as illustrated by one of the examples in the Appendix, serious health problems that are attributable to turbine exposure tend to run in families, which might be due to their similar genetics or exposures, but might be a contagion effect).

But whether or not contagion or fear occurs to some extent does not excuse the turbines. This is not a case, like some commentators have tried to portray, that is similar to many people working in a building getting sick, apparently due to mass hysteria since no contamination or infectious agents are found. Unlike a single building, people with no knowledge of or worry about the health effects from other turbines, and who have never known anyone who experienced those problems, have discovered they are having health problems when turbines were built near their homes. Moreover, everyone suffering health problems does detect and usually complains about the sensory effects from the turbines, so it is clear that their entire experience is not imaginary. It is, of course, possible that some personal characteristic sensitizes them to be more bothered by the sensory effects, increasing any psychologically-mediated effects. But it is inevitable that some personal characteristics will be *causal cofactors* (factors that, along with the turbine, are part of the necessary constellation of causes for there to be a disease effect). This is true for every exposure-disease combination: Some exposed people get the disease and some do not, and sometimes we can identify other differences between the two groups. None of this changes the fact that the turbines are causing disease, and are the one of the many causes that we

teaching someone to love Big Brother, and at a more prosaic level it would not eliminate suffering from the moment of first exposure. We have counseling methods that can reduce the long-term damage that someone suffers from being a victim of sexual assault, after all, but its existence does not change the fact that the assault does damage, let alone does it cause us to decide to allow the assaults because the damage can be undone.

Any claim that might stick

It is worth pointing out the dishonesty inherent in presenting many of these claims together, as is often done. It is a legitimate tactic for a criminal defense attorney to argue that the prosecution has failed to show that his client was at the scene of the crime, and that the evidence showed that if he was there it was after the crime was committed, and also that he was just along for the ride and did not know anything about his friend's plan to commit a crime. However, this is not a legitimate tactic in scientific analysis. Proponents of wind turbines have claimed, often simultaneously, that the physical models show there is no possible problem, that there is no problem if some particular rule is obeyed, that there is no evidence of health effects, that the reported evidence of health effects does not count because it in the wrong format, that there is evidence of effects but they are not real diseases, and that the diseases are really the victims' own fault. They also sometimes argue that the benefits outweigh the costs, the point taken up in the final section below.

We can perhaps excuse lawyers who work for the industry for making this contradictory mélange of arguments, assuming that we think it is acceptable for industry to act as selfishly as a criminal defendant is expected to act, and that it is up to others to make the opposing case. But there is no such defense available to consulting scientists who are supposedly writing reports as

refer to as "the" cause in a legal or ethical sense. Compare: If someone is killed in a robbery, the cause of death was the assailant, but the death was also caused by the victim being at the wrong place at the wrong time, and perhaps because those around him were not skilled medics and that he was frail. However, the murderer's blameworthiness is not diminished by (inevitable) existence of causal cofactors.

Some commentators who are unfamiliar with causal analysis in epidemiology seem to believe there is something unusual about personal characteristics being correlated with the outcome. They then compound their error by declaring that if there is something psychologically different about the people who suffer disease, then we can "fix" them with counseling. This has been presented as being a reason why we should not worry about the observed health effects, even though the usefulness of counseling is a purely speculative hypothesis (there is no evidence it has ever been successful in these cases), and one that is built on speculation about there being a "treatable" causal cofactor that is a necessary component of the causal pathways. To return to the lung cancer analogy, someday we will invent a drug that keeps the injured lung cells from turning into cancer, which would mean that smoking would no longer cause lung cancer among people who took the drug, but that is obviously not an argument that smoking is not really causing such harm now; indeed, we would probably still consider the propensity of smoking to trigger lung cancer as consequential even if the hypothetical drug were available.

Moreover, the fact that we have no reason to believe we can actually counsel away the suffering caused by turbines is only part of the problem with such claims. Even if the counseling were useful at reducing the health effects, causing people to need counseling (a substantial cost in their lives even if it is completely successful) can hardly be considered a harmless and ethically inconsequential act. It has complicated ethical implications that evoke the Orwell's

independent experts, or to government officials. They should be conducting the best possible scientific analysis. If one of them really believes that, for example, we should not worry about the health effects because people can and should be counseled to get over them, then they are still obliged to recognize the enormous number of adverse event reports and point out that acoustical theories predicting no effects are apparently wrong, before then going on to argue that the effects are something that is easily fixed. Similarly, someone who genuinely believes that there is not evidence that people are suffering cannot also argue that this non-existent suffering has characteristics that make it less important. Some arguments can legitimately be made in combination, of course. But even honest activists, let alone honest scientists, do not use the approach of throwing every claim that could possibly be made in support of their position against the wall to see what sticks.

Ethical policy decision-making

Public policies often impose substantial costs on people. We generally try to prevent a large share of the burden from falling on a small number of identifiable involuntary victims (e.g., people living near the site of a new noxious facility), but sometimes this is not possible. Generally in such cases it is considered ethically mandatory to compensate the victims. But even setting aside tricky questions of just compensation, there is the simple principle that the total social benefits should outweigh the costs, which include the health costs. There is currently no evidence to support the claim that this is true for the installation of new industrial wind turbines in populated areas.

It is beyond the present scope to even rough out such an analysis, but it is possible to provide the steps that are necessary and point out how nothing remotely sufficient exists. First

the net costs and benefits from a purely industrial standpoint (the resource cost to install, maintain, and decommission the turbines and transmission lines compared to the value of the electricity generated) need to be calculated; this is presumably negative since the industry depends on subsidies of various kinds. A common claim is that this negative value is more than outweighed by the net benefits of pollution reduction, though there is substantial debate about this point. Before there is any possible justification for inflicting involuntary health risks on people, whatever their magnitude, it is incumbent upon the industry to present a convincing analysis that shows there are substantial net benefits when all benefits and costs – apart from those imposed on local residents – are considered. Only such net benefits could justify impose the local costs.

It does not appear that this has ever been done, but for purposes of the exercise assume it has and the result is indeed positive. Then the health and other local impacts need to be quantified and compared to that benefit. While there can be no perfect quantification of such effects, estimates are possible employing well-used straightforward methods. The first step is to admit that there is a problem, which might be made easier by dropping any disagreement about whether the suffering constitutes health effects, since all costs to the local community, health and otherwise, should be identified and quantified. If there are indeed methods for mitigating the damage, and if particular regulatory standards can substantially reduce it, then this should be demonstrated and then implemented to lower the costs. These costs, lowered as much as possible, should then be compared to the other benefits

Many of us have guesses about how this comparison will come out, but the main issue right now is that it has never been done. No one has even taken a rough cut at the numbers, and so there is simply no basis for claiming that the benefits justify the costs. Indeed, this may

explain why many proponents of turbines insist on making the extreme and obviously incorrect claim that there are no health effects at all. Once some numbers are estimated, we can begin to discuss whether the tradeoffs are justified, how to offer justice, and other policy questions. In the meantime, it makes no sense to take expensive largely irreversible actions, rather than exercising some easily reversed prudent delay until we better understand the situation.

Conclusions

It is always possible that further research will reveal that, under certain circumstances, turbines can be sited near people's homes with minimal health risk. Such is always possible for any exposure, given the nature of science (open to additional information) and changing technology. But our current knowledge indicates that there are substantial health risks from the existing exposure, and we do not know how to reduce those risks other than by keeping turbines several kilometers away from homes.

Similarly, it is quite possible a public policy case could be made for the claim that the costs are justified by the benefits. But the key is that the case must be made, including a quantification of the impacts on local residents, which has not been done. Those who pretend that there are no serious impacts on local residents cannot contribute any useful analysis. Moreover, it seems unlikely that it will ever be considered ethically acceptable to force susceptible individuals to suffer serious health problems, to say nothing of the non-health complaints and effects on communities, without much greater and more reliable compensation than has been offered to date.

Dismissal of health effects cannot be seen as honest disagreements about the weight of the evidence. Honest disagreements about scientific points are always possible. But when

proponents of one side of the argument consistently try to deny the very existence of contrary evidence, make contradictory claims, appeal to nonsensical and non-existent rules, treat mistaken predictions as if they were evidence of actual outcomes, play semantic games to denigrate the reported outcomes, and blame the victims, then they are not being honest, scientific, or moral. They are preventing the creation of optimal public policy and damaging the credibility of science as a tool for informing policy. Moreover, since their lack of plausible arguments suggests there are no defensible arguments to be made on that side of the issue, their persistence in making implausible arguments is directly responsible for hurting significant numbers of people.

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Appendix: Excerpts from three adverse event reports

Case 1, first person report by male, 2007

...

The first 2 turbines were operating in may 2004. One was 4000ft from our home, the second 4700ft. A 120 day trial period was required to monitor their productivity. We could hear them well and ..., my wife was experiencing ringing in her ears. Visitors would comment that the one 4000ft away seemed really close. Some neighbors were complaining they were bothered by them at night.

...

February, 2005 the windfarm was fully operational, 17 wind turbines. The windmill 4000ft away seemed far off compared to the one 1000ft from our home. They are loud. They've been compared to jet engines, a plane that will not take off. There is no gentle swoosh, it is a whoosh noise. They grind, they hang, they creak. The noise is like surround sound, it's omnidirectional. It feels like there's this evil thing hovering above you and it follows you everywhere, it will not leave you alone. This noise will not allow you to have your own thoughts, the body cannot adapt, it's a violation of your body. It is a noise that the human body cannot adapt to even after more than a year of exposure. As time progresses the noise becomes even more unbearable.

Our 5 year old son ... was afraid and unable to sleep in his own bed for more than one year. He would get in our bed or in his brother's bed. We would put him to bed at 8:30 and many nights at 11:00 he would still be awake. Finally he would fall asleep wrapped up in the blankets in the fetal position with his head covered and with a fan at his head. we had to create more noise to mitigate the windfarm noise. The body can adapt to the fan noise. In the morning he would get up tired and cranky. In september 2005 he started school and he was not getting enough rest. He began getting more and more aggressive with his friends. He was very defiant We knew he was suffering terribly. He's had throat infections and often had a fever and not feeling well.

...

We abandoned our home February 21st, 2006.

Since the move [aforementioned son] has been doing much better. He sleeps in his own bed every night. He sleeps partially covered with his arms and legs spread everywhere. It was only ten days after the move while he was having his back rubbed in bed he said "it's nice to be able to go to bed and sleep". He is much less defiant. He has become the kind gentle little boy he was before the windfarm nearly destroyed his life.

Knowing what we know now we should have moved a year before

Our 9 year old son ... was sharing a room with [5-year-old]. He was also very sleep deprived. He would get up in the morning very tired. We would send him to school tired. He was tired and

unable to concentrate and his school work suffered. He was also unable to concentrate on his homework. He began to withdraw within himself. He also began getting aggressive. [He] seemed to be always angry. His teacher asked us what was the problem with [him] because his change in behavior was something she would never have expected from him. [His] ear drum burst while we were there in 2005. He's had many throat infections and many headaches. He has developed allergies. He's the only one of 6 children that has allergies.

Since the move [he] has improved so much in his school work and his behavior and participation in class that the teacher says she cannot believe that he's the same child. He has not been aggressive with his friends. He's so kind and caring for everyone. His headaches are less frequent and less severe.

Our 13 year old daughter ... had dramatic behavioral changes. She became withdrawn and was spending too much time alone in her room. She dropped her friends and lost interest in school work. She was also angry. She dropped all sports (basketball, volleyball, soccer, badminton). [She] always had headaches. She became very defiant.

Since the move [she] is doing better in school. Her behavior is steadily improving. Her health is improving and she is socializing. She is feeling better about herself.

[...reports on other family members omitted for length...]

As for myself I always felt a sensation in my chest which was very disconforting. On extremely rare occasions when the windfarm was off I could sense they were off without seeing them. The noise was just a relentless attack on our bodies. Every time the blades passed the towers I could feel it within my body. I was unable to concentrate well enough to read in my bed.

Since the move I don't have that sensation in my chest but it returns when I spend a few hours at our house.

These physical and psychological effects develop gradually and sometimes it seems silly to associate them with a windfarm until you learn that others experience the same thing under similar conditions.

If we would have had absolutely nowhere to go, if we would have been forced to stay in our home, I hate to think what kind of physical and mental state we would be in now.

During the months that the sun is low in the sky we get a flickering in the morning and late afternoon as the sun posses behind the turbines. This induces headaches quickly to those who are more susceptible to them. When the full moon rises and passes behind the turbines the flickering is intense.

We are devastated, we are broken because we have lost the home we built with our own hands and we have lost the land which has been in the family for generations.

Our house is now unsellable. There is nobody in the community that wants to live there because of the windfarm. Nearly everybody supports us privately but they are afraid to speak out publicly.

We are a community of 2000 people and I did a survey of 216 people and 96% said the windfarm was too close to [their] house. Also 89% said the windfarm was too loud at [their] house and 78% said that they felt they were not properly notified of the impact this windfarm would have on the community. ...

Case 2, first person report by female, 2009

...

My home now sits among huge, massive turbines. Sixteen turbines surround me, all within a 3 km radius of my home. The closest is 400 metres from my back door. People often ask me what my problem is with the turbines. ("They are not very noisy," I am told.)

The noise is constant, some days louder than others. It is not noise I enjoy or choose to be around. It is noise I cannot escape.

...

I live with the movement of shadow flicker created by the rotation of the turbines, coming through my dining room window as I drink my coffee in the morning. I have developed a sensitivity in which now I cannot even tolerate the movement of a small ceiling fan.

The skies where I live are no longer clear but dotted with blinking red lights marking the height of the turbines. When the turbines are down, a constant buzzing noise is emitted from the motionless structures. I have developed tinitus [sic] in my ears. I hear and feel the pulsating of the turbines and buzzing in my ears. I also feel the pulsating in my throat and chest.

Two homes have been abandoned where I live because of health reasons related to the effects of the turbines. One of these properties is host to 2 turbines. Many properties are for sale. In fact most of the properties where landowners reside on premises are for sale.

Real estate sales in my area are significantly less than other [similar places]. Some real estate brokers will not touch a property adjacent to a turbine for fear of future law suit. Nothing is selling in Turbine Town. Land value has decreased significantly because of the turbines.

...

I have:

- nausea (often) & dizziness (often)

- significant hearing loss
- itchy eyes
- high blood pressure (recently, an immediate and intense elevation to 180/118, causing severe headache and complete dysfunction)
- heart palpitations
- achy joints
- short term memory loss
- severe sleep deprivation on a regular basis

Results of a sleep study I had done showed 214 interruptions in a 6 hour period (note: 6-8 is considered normal; 214 is comparable to someone who has attention deficit disorder). I have very little if any regenerative sleep periods. I have been told that I have developed a sensitivity that does not leave my body when I leave the vicinity of the turbines. The term used was "toxic" -- my body is in a toxic state.

I have an ulcer in my nose that does not heal. I am awaiting an appointment in November with an ears, nose and throat specialist (otolaryngologist).

I often have blood in my urine (never was a problem in the past). I am having problems with my lymph nodes. I have been anaemic because of excessive blood loss. Blood work and other tests do not indicate changes which may cause this haemorrhaging. I have spent time in the emergency room at the hospital because of this.

I once thought my degenerating health was part of the natural aging process. I did not believe the turbines could be the cause of my health issues. I questioned myself as to whether or not it was all in my head. I now believe exposure to the turbines accelerate these processes as well as create other health problems.

I am angry, helpless, and disappointed our government would let something like this happen. I am appalled at their ignorance and lack of compassion. It saddens me to watch my family and friends suffer from the same effects of the turbines.

It is also very saddening for me to see my dogs suffering. I cannot imagine the distress they must be enduring because of their sensitive hearing. I have not figured out what to do about it.

I spend as much time as I can away from my home, away from my son who is also sleep deprived and moody. We are exhausted and miserable. I often seek refuge with friends, often falling asleep minutes after I arrive. They are very understanding.

....

Case 3, first person report by mak, 2010

I am an abutter to ..., a 1.65MW Vestas 400 foot tall goliath. Since it went into operation in early 2010, quite a number of us abutters have suffered serious medical detriments and a gigantic loss of quality of our lives from the noise impact of this machine.

My own home is 1662 feet from the turbine, and the effects of the sound on me have caused

-anxiety
-stress
-nervousness
-sleep deprivation
-hypertension
-migraines
-dizziness
-blurred vision
-palpitations
-irritability
-anger
-upset stomach
-depression

These ailments are well documented by my medical providers.

....

The noise these turbines make is unlike regular noise. It is not the loudness of the noise but a characteristic to it that gets in your head and becomes entrenched. The sound can go on for days,

or it can be absent, or it can be intermittent. When it is not there, one listens for it and is fearful of its return.

The garden that was a sanctuary to me for 30 years is now more like a torture chamber. Some of the abutters have started using the term "turbine torture." When the turbine first went into operation in March 2010, and then through April, I tried to acclimate myself to live with this thing.

After dropping into a three-month depression, I finally avoided my own home for the month of August, and pulled out of the depression. I returned on Labor Day weekend to find that after ten minutes of hearing the turbine, my anxiety and panic condition were returning. At least two persons have thought of suicide while this issue drags on through the creep of political process.

....

Anyone out there whose town or neighbor is proposing a wind turbine, I recommend for you to do your homework now before the machine is up and running, and you begin to plan to sell your home. I have been told, by the way, that if you are trying to sell and a turbine is visible from your home, your potential buyer list will drop by 50%.

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Invited Paper

Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document

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ABSTRACT Our purpose is to provide a comprehensive, science-based, objective, and practical guidance document for assessing impacts of wind-energy development on nocturnally active birds and bats. We first review the current state of knowledge regarding impacts of wind-energy facilities on birds and bats, including both direct mortality and indirect effects. We then provide detailed descriptions of methods for measuring potential impacts, including pre-construction surveys, estimating collision mortality, and studying behavioral responses to wind turbines. We conclude with recommendations for developing and implementing research programs designed to assess impacts at wind-energy facilities sited in a variety of habitats. We emphasize the importance of applying a rigorous, hypothesis-driven, experimental framework to the design and implementation of studies of impacts. We also provide guidance for standardizing methods of collecting, summarizing, and interpreting results so that valid comparisons among studies and facilities can be made. We recommend that research be conducted at multiple spatial scales and that both short-term and long-term impacts be addressed. We suggest that results be evaluated within the context of local populations and regional landscapes. Developers and researchers should work closely with regulatory agencies, local governments, and other stakeholders throughout the planning, construction, operation, and decommissioning phases of wind-energy projects. Finally, we suggest that results be reported in a timely manner and in a format that facilitates their dissemination to the scientific community, resource managers, and the general public. (JOURNAL OF WILDLIFE MANAGEMENT 71(8):2449–2486; 2007)

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Wind energy is one of the fastest growing sectors of the energy industry (Pasqualetti et al. 2004, National Research Council [NRC] 2007), a relatively recent development that has led to unexpected environmental consequences (Morrison and Sinclair 2000, Manville 2005, Kunz et al. 2007). The large corridor of raptor fatalities discovered in Altamont Pass in California in the early 1980s triggered widespread concern from environmental groups and wildlife agencies about possible impacts to bird populations (Anderson and Estep 1988, Estep 1989, Orloff and Flannery 1992, 1996). Anderson et al. (1999) comprehensive review and analyses of methods and statistics for the study of impacts of wind-energy facilities on birds provided valuable guidelines for assessing diurnally active wildlife but offered limited guidance on methods for assessing impacts on nocturnally active birds and bats. Given the projected growth of the wind energy industry in the United States and emerging concerns over possible cumulative impacts of wind energy facilities on nocturnally active birds and bats (Cumulative Actions Working Group [CEQ] 2005, Manville 2005, NRC 2007, Arnett et al. 2008), we developed this document to supplement the earlier methods and protocol documents.

The methods and protocols we consider herein include those suitable for assessing both direct and indirect impacts of wind energy. Direct impacts of wind-energy facilities refer to fatalities resulting from striking birds and bats being killed directly by collisions with wind turbine rotors and meteorpoles. Indirect impacts of wind-energy developments refer to disruptions of foraging behavior, breeding activities, and migratory patterns resulting from alterations in habitat-use caused by nocturnally active birds and bats. Direct and indirect impacts on birds and bats can contribute to increased mortality, alterations in the availability of food, water and nest resources, increased risk of predation, and potentially altered demographics, genetic structure, and population viability (NRC 2007).

LIMITS OF CURRENT KNOWLEDGE ABOUT IMPACTS ON NOCTURNALLY ACTIVE BIRDS AND BATS

Songbirds

Songbirds are by far the most abundant flying vertebrates in most terrestrial ecosystems, and until recently have been

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among the most frequently reported fatalities at utility-scale wind facilities in the United States. In a review of bird collisions reported from 31 modern utility-scale wind-energy facilities in the United States, Erickson et al. (2001) showed that 20% of carcasses found at wind-energy facilities outside of California were songbirds protected by the Migratory Bird Treaty Act (16 United States Code 703–712), among them, approximately half were nocturnal, migrating passerines. The number of passerine fatalities reported in other studies has ranged from no birds during a 3-month survey at the Searsburg, Vermont Wind Energy Facility, Searsburg, Vermont, USA (Arnett 1997) to 11.7 birds per megawatt (MW) per year during a 1-year study at Buffalo Mountain Wind Energy Center, Anderson County, Tennessee, USA (Nicholson 2003). Given the increasing number of installed and proposed wind energy facilities, the relatively large number of passerine fatalities at wind-energy facilities on forested ridge tops in the eastern United States, such as Buffalo Mountain Wind Energy Center, Anderson County, Tennessee, and the Mountaineer Wind Energy Center, Tucker County, West Virginia has raised concerns regarding the potential risk to nocturnally active songbirds (Kerns and Kerlinger 2004, GAO 2005, Fiedler et al. 2007, NRC 2007, Arnett et al. 2008).

Bats

Recent monitoring studies indicate that relatively more wind-energy facilities in the continental United States have killed considerably more bats than were expected based on early monitoring studies where birds were the primary focus of attention (NRC 2007). Large numbers of bats have been killed at wind-energy facilities constructed along forested ridge tops in the eastern United States (GAO 2005, Kunz et al. 2007, NRC 2007, Arnett et al. 2008). The highest fatality rates at these facilities have ranged from 15.3 bats/MW/year at the Meyersdale Wind Energy Center, Somerset County, Pennsylvania to 41.1 bats/MW/year at the Buffalo Mountain Wind Energy Center (Fiedler 2004, Kunz et al. 2007, NRC 2007, Arnett et al. 2008). A recent follow-up study conducted at the Buffalo Mountain site reported fatality rates of 53.3 bats/MW/year at 1 small (2-mw-MW) Vestas V47 wind turbines (Vestas Wind Systems A/S, Ringkøbing, Denmark) and 20.2 bats/MW/year at 11 larger (1.8-MW) Vestas V80 turbines (Fiedler et al. 2007). Another recent study, conducted at the Mapleridge Wind Power Project, Lewis County, New York, USA, estimated bat fatalities ranging from 12.3 bats to 17.8 bats/MW/year (depending on current search frequency) at 1 65-MW Vestar wind turbines (Jain et al. 2007). Bat fatalities reported from most other regions of the United States have ranged from 0.8 bats to 8.6 bats/MW/year, although these estimates were largely based on studies designed to estimate bird fatalities (but see Johnson et al. 2003, 2004, 2005). In addition to these fatalities, bats have been killed at wind-energy facilities located in agricultural areas of southwestern Alberta, Canada (Barclay et al. 2007), and in a mixed-wood–shrub grassland landscape in north-central Oklahoma, USA (Piorkowski 2006). Little is known, however, about potential risks and fatalities in other regions of North America where wind energy facilities are being developed at an unprecedented rate.

Challenges to Impact Assessment and Prediction

Predicting impacts on bird and bat populations based on fatalities reported from existing wind facilities presents several challenges. Lack of reliable estimates for many factors associated with searcher efficiency and scavenging make it difficult to derive reliable estimates of fatalities for a given site or region, let alone to construct results from different regions and years to confidently predict cumulative impacts (Kunz et al. 2007, NRC 2007, Arnett et al. 2008). Several studies using radar have been conducted during pre-construction periods in efforts to estimate potential risks to nocturnal migrants. However, to date, none have provided sufficient evidence to reliably predict actual risk. In part, this may reflect the fact that existing sites typically have different ecological characteristics than both before and after development (e.g., undeveloped forested ridge top vs. cleared ridge top with installed wind turbines).

Bias correction factors.—Scavengers are known to remove bird and bat carcasses before researchers are able to discover them and, thus, fatality rates will most likely be underestimated unless reliable estimates of scavenging rates are developed and applied to observed fatalities (Morrison 2002). Bias correction factors also are needed to adjust fatality estimates for searcher efficiency. For example, a study in West Virginia used test subjects (birds and frozen bats or birds) to evaluate searcher efficiency and found that, on average, only about half of the animals were found by human observers (Arnett 2005, Arnett et al. 2005). Moreover, bats killed by wind turbines were more or less likely to be found by human observers in grassland areas compared to those in agricultural landscapes and along cleared forested ridge tops. In a related study, trained dogs were able to find 75% of the bat carcasses during searcher-efficiency trials at the Mountaineer site in West Virginia and 81% at the Meyersdale site in Pennsylvania, compared to 42% across 14 sites, respectively, by human searchers (Arnett 2006).

Causal mechanisms of impact.—Comparisons of the wind-energy industry is limited or help researchers develop a better understanding of how birds and bats interact with wind-energy facilities and to help identify the causal mechanisms of impact (Kunz et al. 2007, NRC 2007). Research and monitoring studies are needed to assess attractants and disturbance of birds and bats by lighting, construction (e.g., before turbines have been cleared and forest fragments have been isolated), after turbines have been installed (but before they become operational), and 3) after they have become operational, to test hypotheses needed to assess impacts of wind-energy facilities on birds and bats (Kunz et al. 2007, NRC 2007).

Results of such research could help researchers identify and the wind industry implement mitigation measures to avoid or minimize impacts on nocturnally active wildlife at existing facilities. For example, studies using thermal infrared imaging (Horn et al. 2008) and evidence from bat radiotags estimated at the Mountaineer and Meyersdale Wind Energy Centers in 2004 (Arnett 2005, Arnett et al. 2008) indicate that most fatalities occurred at times of low wind speeds (typically <6 m/sec), conditions under which rotor blades are rotating but the amount of electricity generated is minimal (NRC 2007). These data suggest that a first-order priority should be to test the hypothesis that bat fatalities could be massively reduced by mechanically feathering turbine blades (i.e., rotationally pitching the blades parallel to the wind, effectively making them stationary) at low wind speeds (Kunz et al. 2007, Arnett et al. 2008).

Well designed before-after-control-impact (BACI) and comparison studies, and those that test treatments of birds and bats to different operational conditions, are needed to fully evaluate options for mitigating fatalities to birds and bats at wind-energy projects (Kunz et al. 2007, NRC 2007). In this context, some interim has been obtained with experimental use of new turbine designs (e.g., lattice towers replaced with monopoles and tower and tubular turbines) and by testing visual deterrent by using different colors on turbine blades (Hudson 2005). A current study is underway to test the efficacy of ultrasonic deterrents (E. W. Arnett, Bat Conservation International, unpublished data).

We summarize methods for assessing risks to birds and bats associated with proposed and operational wind energy facilities. A variation of methods are available to observe nocturnal activities of birds and bats, including: night vision observations, thermal infrared imaging, radar monitoring, acoustic recordings, and radiotracking (telemetry). Other research methods, including direct capture, collection of tissue for stable isotopes and DNA analysis, estimates of population size and genetic structure, and fatality assessments, provide critical information needed to assess direct, indirect, and cumulative impacts.

METHODS AND METRICS FOR OBSERVING NOCTURNAL BEHAVIOR OF BIRDS AND BATS

Current understanding of where, when, how, and why bats and nocturnally active birds come into contact with wind turbines is limited by our ability to observe how they behave near these structures. Answering some of the most basic questions requires careful observations with appropriate methods to assess the nocturnal and seasonal timing of flight behavior of birds and bats in the vicinity of proposed and operating wind turbines. No single method or protocol can be used to quantify possible issues temporal and spatial variation in natural populations of the impacts of wind turbines on nocturnally active birds and bats. Each method or method has its own strengths, limitations, and biases, and the selection and application of any or multiple methods will depend on the specific objectives to be addressed. Sufficient information thus will be required to enable researchers to meet the stated goals of a proposed study. To avoid misinterpreting results, assumptions and limitations of each method must be explicitly acknowledged and understood (e.g., Hayes 2000, Gannon et al. 2003). Moreover, individuals charged with monitoring the activities of birds and bats must be thoroughly familiar with the operation and limitations of each method or device before initiating field studies.

Visual Methods for Monitoring Nocturnal Activity

Making meaningful visual observations requires not only selecting the appropriate methods and equipment (Allison and De Stefano 2006), but it is essential that temporal and spatial scales of observations also be included to answer relevant questions.

Moon watching.—Early investigators used a moon-watching technique during full moon periods with binoculars to observe migratory birds (Lowery 1951, Lowery and Newman 1955). By assessing a telescope of sufficient power (20–30×) toward the full moon during periods of migration, it is possible to observe silhouettes of birds and bats as they pass before the illuminated disc of the moon. The primary limitation of this method is that sampling conditions are limited to cloudless nights with a full moon.

Ceilometry.—Given the limitations of moon watching, Gauthreaux (1969) developed a portable ceilometer to observe low-altitude nocturnal migrations on nights when the moon was not visible. This method employed an auxiliary light source (e.g., 100-W lamp) to illuminate a portion of the night sky that could then be targeted using binoculars or a spotting scope. This method has been used to detect large numbers of bird species flying ≤300 m above ground level (agl) with 7× binoculars, several bird species ≤450 m agl with a 30× telescope, and at detecting larger passerines (e.g., tanagers) ≤640 m agl with a 30× telescope (Gauthreaux 1969).

Able and Gauthreaux (1975) used a ceilometer to quantify the nocturnal migration of passerines, and expressed the magnitude of migration as the number of birds per 1 km of migratory front per hour, a metric derived from moon watching that also is amenable used in some radar studies. Williams et al. (2001) used 300,000 candle power (cp) spotlights instead of portable ceilometers for observing passing of threats sized passerines (>300 m agl). The ability to detect airborne targets at night using artificial illumination diminishes with the square of distance from the observer and, thus, will depend on the intensity and effective range of the source of illumination.

Although ceilometers can provide information about relative traffic rates of nocturnal migrants, the beam of light samples a very small area relative to the available area potentially occupied by nocturnal migrants. Additionally, visible light from the ceilometer tends to attract birds and insects and, thus, can lead to biased results. This problem was recognized by Williams et al. (2001), whose birds were observed around dim light scattered from the ceilometer. Extensions of flight altitude around from this method also might be biased due to the greater probability of visually detecting lower flying birds and the general difficulty of visually estimating flight altitude. Detection biases associated with this method have not been objectively quantified.

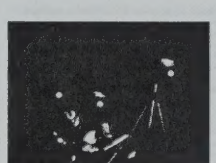

Figure 1. Thermal (infrared) imaging and recording systems of bats and birds at wind-energy facilities using night vision goggles and a night-vision scope (upper) and thermal (infrared) video (lower). P. B. Cooper, Avian Ecological Research, Inc. (unpublished data).

Figure 2. Thermal (infrared) image of foraging bats in relation to wind-energy facilities in south-central Texas, USA. Many bats are foraging close to rotor-swept area of the wind turbines (T. H. Kunz and M. Betke, Boston University, unpublished data).

Night-vision imaging.—Visual observations that employ night-vision goggles (NVGs) and scopes, powerful (>million Cp) spotlights, and sufficient infrared cameras have greatly improved in recent years. Improvements of the NVG method now enable visual methods include 1) greater detection in hollow and densely birds, bats, and insects; 2) use of both fixed and mobile viewsights that increase the ability to detect and identify animals correctly; and 3) infrared video that documents airborn animals, insects, birds and bats in supplemental sources of wildlife light.

These improvements have made it possible to identify small birds and bats alert at distances ≤100 m. Mabee et al. (2006) used first-generation NVG with a 1× magnification (Model: ATN-PVS7, American Technologies Network Corporation, San Francisco, CA), along with 2 1-million-Cp searchlight fitted with infrared filters to observe flying targets from at a forested wind energy facility in New York state. Using this method, Mabee et al. (2006) showed that night sky through NVG and were able to track and directly count targets using the stationary spotlight (mounted on a tripod with the beam directed vertically) and a mobile spotlight (handheld with the beam parallel to the forest searcher's beam; Fig. 1).

For each bird or bat detected, flight direction, flight altitude, and flight behavior (e.g., straight-line, zig-zag, circling, hovering) often can be determined. Species identification, however, is rarely possible using this method. Video recordings of flight behavior can be recorded and analyzed repeatedly to determine how birds or bats respond to moving wind turbines. Metrics produced from NVG images include proportions of birds and bats observed flying at various altitudes (≤350 m agl), the rates detected (or passing) and bats can be discerned among the methods, flight direction, and relative number of birds and bats observed per hour (standardized by estimating distance categories of and when comparisons among studies are made).

Limitations of the NVG method include variable detection rates of animals because of cloud cover, atmospheric moisture, and the effect of distance on detection. Night-vision devices, each of which contain photo-multiplier cells, also produce inherent visual noise, often making it difficult for observers to distinguish small birds from bats at night, even within the height of the rotor-swept zone of utility-scale wind turbines.

Thermal infrared imaging.—In contrast to night-vision technology, thermal infrared imaging cameras are designed to detect heat emitted from objects in a field of view without the need for artificial illumination. The electronic heat produced by birds and bats (and even insects) produces a distinct image against a cooler background (Fig. 2). Typically, images can be captured at rates ranging from 30 frames to 180 frames per second (fps), depending on the camera, and digitally recorded to computer hard drives. Automated detection and tracking algorithms have been developed that may greatly useful for assessing the behavior of birds and bats flying in the vicinity of wind turbines (Desholm et al. 2006, Betke et al. 2008).

Several studies have employed thermal infrared imaging cameras to observe movements of birds and bats flying near wind-energy facilities. Desholm (2003) and Desholm et al. (2004, 2006) used a long-wave (7–14 μm) thermal infrared camera (Thermovision 1840W, 320 × 240; Forward Looking Infrared [FLIR], Boston, MA), deployed as part of the Thermal Animal Detection System for automatic detection of avian collisions at an offshore wind-energy facility in Denmark. This system is triggered automatically when a target is detected and can be controlled remotely. In southern Germany, Steinborn et al. (2006) used a Mitsubishi Thermal Imager (IR-M320AD, Mitsubishi Electric Corporation, Kamakura, Japan) to observe bats in the vicinity of 8 wind turbines. This thermal camera operates at short wave lengths (3–5 μm) at 60 fps, and had a detector array consisting of 512 × 512 pixels, and with a 50-mm, F1.2 coloured lens, generated a 14° × 11° field of

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Figure 3. Configuration of thermal infrared camera in relation to the dimensions of turbine upon (i.e., base, hub, and nacelle) at the Mountaineer Wind Energy Center in Tucker County, West Virginia, USA. Camera was positioned 30 m from the turbine base and inclined slightly upward and perpendicular to the plane of blade rotation. Observed bats, birds, and insects were classified into flight, bat, and non-flight categories corresponding to flight elevation above ground level (from Horn et al. 2008).

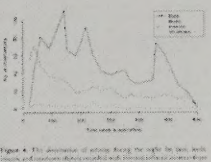


Figure 4. The distribution of activity during the night for bats, birds, insects, and nonflying objects recorded with thermal infrared cameras during 2006 and 2007 at the Mountaineer Wind Energy Center in Tucker County, West Virginia, USA. August 2006 (from Horn et al. 2008).

view. With this system, flight patterns of bats could be distinguished at a distance of 100 m.

Liechti et al. (1995) used a long-range thermal imaging unit (Long Range Infrared System, IRTV-445), infrared optics, Nashua, NH) with a 1.45° edge-to-edge lens and were able to detect nearly 100% of all aerial movements within the field of view at a distance of 1,000 m. The units used were sited in Sweden to measure autumn bird migration (Zehnder and Liechti 2003, Zehnder et al. 2003) and in Africa, on the edge of the Sahara desert, to study nocturnal bird migration (Liechti et al. 2003). Gauthreaux and Livingston (2006) used a thermal imager (Radiance 1, Amber Raytheon, Goleta, CA) to study nocturnal migration at Pendleton, South Carolina, and Wilmington Island, Virginia, USA, when weather conditions were calm and relatively clear (based on local data collection). Daylight observations were made at McFaddin National Wildlife Refuge, Texas, USA. This thermal imaging camera, with a 500-mm lens, and a field of view of 5.57° (horizontal screen dimensions) and 4.17° (vertical screen dimensions), recorded data at 60 fps, and yielded an image of 402 × 640 pixels at full-screen resolution. A vertically oriented thermal imaging camera and a fixed-beam vertical pointing Pathfinder radar (Model 1630 [Raytheon Inc., Marshpointe, NH]) was used with a parabolic antenna (60 cm diam) that produced a beam width of 4° at minimal 3 dB, use, and insect movements based on the characteristics of tracks in the video images and the altitude of the target derived from the radar unit. Data from the thermal imaging camera and radar were combined into a single video image and stored on digital videotape. This approach produced quantitative data on migration traffic at several altitudinal bands and made it possible for the investigators to distinguish birds from insects and foraging bats.

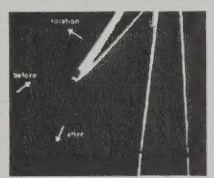


Figure 5. A time-lapse series of 3 successive frames of thermal infrared video of a nocturnal migrant bird immediately before and after collision with an instrumented wind turbine operating on 14 August 2004 at the Mountaineer Wind Energy Center, Tucker County, West Virginia, USA. The bird approached the rotating blade on a viewing trajectory below normal, but its heading and speed changed rapidly as the bird accelerated toward the ground. Only the single frame in which collision occurred is shown for clarity (from Horn et al. 2008).

Horn et al. (2008) employed 3 FLIR Systems S-60, (personal) multi-frame/sec thermal infrared cameras (FLIR, North Billerica, MA), with matched and calibrated 25° lenses to observe the behavior of bats in the vicinity of operating wind turbines at the Mountaineer Wind Energy Center in the Mid-Atlantic Highlands, West Virginia (Fig. 3). Data were captured at a rate of 30 fps and recorded directly to external 250-gigabyte hard drives that were connected to laptop computers. Horn et al. (2008) showed that bat activity near wind turbines during August was highly variable on a nightly basis, with most of the activity of bats occurring during the first 2–3 hours after sunset (Fig. 4). Although airborne insects were most active in the first several hours after sunset, their activity was highly variable

Horn et al. (2008) suggested that the probability of being struck by moving turbine blades (Fig. 5) could be predicted by a combination of insect activity shift and nightly weather conditions. In addition to bats struck directly by entering turbine blades, Horn et al. (2008) also observed flying bats investigating moving rotors and the entire pole. Bats sometimes alighted upon and appeared to explore the nacelle and rotor blades, suggesting that they may be attracted to these structures.

Results from thermal infrared imaging cameras ideally should be compared with other methods including radar and acoustic detection for monitoring bird and bat movements in the lower atmosphere at the height of wind turbines (Liechti et al. 1995, Gauthreaux and Livingston 2006). Many of the limitations of other visual methods are common to thermal infrared imaging, but the latter method also creates a relatively high cost with large data processing requirements. Current costs for the purchase of suitable thermal infrared cameras ($60,000–$90,000) are expected to decrease in the near future.

Light tagging.—Small, chemiluminescent light tags or nite glow sticks offer the potential for observing the flight behavior of individual bats in the vicinity of proposed and operational wind energy facilities. Light tags have been used to track bats for investigations of roosting and foraging behavior (Barclay and Bell 1988, Kunz and Weise 2004). Small, chemiluminescent capsules (2 × 13 mm), normally used as fishing lures, make excellent inexpensive light tags for marking and observing bats at night. Battery-powered light-emitting diodes (LEDs) also can be used for marking and observing bats flying at night (Barclay and Bell 1988, Kunz and Weise 2004). Depending upon the size of the battery and the oscillation frequency of LEDs, such tags can last up to 14 days. Commercially produced LED tags are available in green and red light and are relatively small (1 × 1.2 mm and 1.6 g), with the battery and circuitry encapsulated in inert waterproof epoxy (Holohil Systems Ltd., Carp, ON, Canada).

Chemiluminescent tags and LEDs should be attached to the mid-dorsal region of bats with Skin-Bond® surgical adhesive (Smith & Nephew, Largo, FL). Attaching light tags to the ventral surface of bats should be avoided, because a tag in this position may interfere with females if they have dependent young. Barclay (1989) and Barclay and Childs (1992) used chemiluminescent light tags to assess the diet, foraging, and foraging behavior of nocturnal bat species. Other investigators (e.g., LaVal and LaVal 1980, Aldridge and Rautenbach 1987) have used chemiluminescent and LED tags with the greatest success when observations were made in open areas, or forays and along forest edges and, thus, such tags may be particularly valuable for observing bats in the vicinity of wind turbines.

Use of chemiluminescent light tags may offer opportunities to observe the behavior of bats in response to sounds produced by moving wind-turbine blades or to visual cues that may attract bats to these structures (NRC 2007). Barclay and Childs (1992) attached light tags to big brown bats (*Eptesicus fuscus*) and found that individuals navigated to feeding grounds by following acoustic cues produced by calling frogs and attacking insects. Light tags also can be used to follow individuals while their echolocation calls are monitored with ultrasonic detectors and, thus, can be used to validate species-specific calls (J. Szewczak, Humboldt State University, personal communication).

The primary limitation of chemiluminescent tags is that their output is detectable only for a few hours. By contrast, LED tags can last upwards of 3 weeks. Another limitation is that bats often die rapidly beyond the field of view, and generally cannot be followed in acutely fractured areas. Moreover, in aerial interactions light-tagged bats may be difficult to distinguish from fleeting birdies. More recent evidence suggests that bats carrying light tags may interfere with the social interactions of roosting bats (Kunz and Weise 2004).

Analysis of visual data.—With the exception of data derived from light tags, visual based surveys of bat activity using stationary, night vision, and thermal imaging cameras should report number of passes per recording hour or mean number of passes per recording hour. For consistency and comparisons, recording time should be normalized to minutes past sunset. This protocol facilitates pooling and comparing data throughout a season or across multiple seasons (Horn et al. 2008). In addition to assessing overall activity, data should be documented by date, camera type, and biases used to characterize temporal or spatial peaks in activity. Data on bat, bird, and insect activity derived from thermal infrared imaging or other visual methods should be compared with meteorological data to establish potential effects of these variables on relative abundance and nightly and seasonal activity.

Radio Detection and Ranging (Radar)

Radio detection and ranging (radar) has been used for over half a century to investigate nocturnal flight activity of birds, insects, and bats (Eastwood 1967, Vaughn 1985, Gauthreaux and Belser 2003, Larkin 2005, NRC 2007). However, only recently has this technology been used to evaluate the activity of airborne targets in the vicinity of wind energy facilities (Mabee and Cooper 2004, Desholm et al. 2006, Gauthreaux and Livingston 2006, Mabee et al. 2006*a*, *b*). Radar operates by transmitting pulses of electromagnetic radiation (radio waves) and then receives the waves that reflect back from an object (e.g., insect, bird, bat, plane, or ship). Radio waves travel close to the speed of light and the distance to the object is, thus, related to the time lapse between transmission and reception of the echo. Detection of objects at a distance depends upon many factors, including area of the radar cross-section of the object and the wavelength and power output of the radar. For birds, this distance may vary from a few hundred meters when using the smallest marine radars to >20 km in the case of long-range weather surveillance radars. For more details on theory and operation of radar, see Skolnik (1990) and Larkin (2005).

Weather surveillance radar.—Weather Surveillance Radar-1988 Doppler, also known as Next Generation Radar (NEXRAD) provides a network of weather stations in the United States operated by the National Weather Service (NWS), making it possible to monitor movements of insects, birds, and bats that move over large areas (i.e., within approx. 200 km). The United States military, local television stations, and municipal airports use similar weather radar systems, but data generated by these installations generally are not available to researchers. Data generated by the NWS operated NEXRAD facilities are for the most part free of charge via the Internet. Data generated from these weather surveillance units can be used to determine general migratory patterns, migratory stopover habitats, mass takeoffs, and nightly dispersal patterns (Fig. 6), and to assess the effects of weather conditions on bird behavior (Diehl et al. 2003, Gauthreaux and Belser 2003, Diehl and Larkin 2004, Horn 2007, NRC 2007).

However, NEXRAD cannot be used to characterize high-resolution passage rates at individual data sets sited spatially within the area resolution of 2° × 250 m, which is about 0.2 km² at 40-km range). The high resolution of NEXRAD often makes it difficult to filter out insect noise from data on birds and bats because it does not provide information on individual targets. Owing to the curvature of the earth and standard beam-bending (e.g., atmospheric lofts or inversions) that could targets from radar's NEXRAD radar cannot provide spatial coverage at or below wind turbine height. Nonetheless, NEXRAD can be a valuable tool for assessing spatial and temporal patterns of daily and nightly dispersal of birds and bats (Russell and Gauthreaux 1998, Diehl et al. 2003, Horn 2006, Horn 2007, Fig. 7).

Tracking radar.—Tracking radar systems, originally designed to lock onto and follow targets such as aircraft or missiles, can provide information on flight paths of individual insects, birds, and bats (including altitude, speed, and direction) including wing-beat signatures to discriminate them taxa while in flight (Fig. 8). Interior applications using tracking radar have been described for birds (Mabee 1977, Seiffinger 1980, Larkin 1991, Bruderer 1996, Liechti et al. 1996), bats (Bruderer and Popa-Lisseanu 2005), and insects (Drake 1985, Drake and Farrow 1988, Wolf et al. 1995, Chapman et al. 2004, Green and Mao 2005). To date, tracking radar has not been commonly used to assess encounters of birds and bats at wind-energy facilities because 1) this investigation does not provide a broad view of migration over a given area, 2) it is not readily available, and 3) it is difficult and expensive to maintain and repair.

Marine radar.—Marine (X-band) radar systems were originally designed for use on moving boats, but these units have been used as mobile units on land for research and monitoring of airborne targets, including passage rates, flight paths, flight directions, and flight altitudes of nocturnal migrating birds. Mobile marine radar laboratories often consist of units that are mounted on top of a vehicle, trailer, or on a ground-based platform (Fig. 9). When the antenna is in the horizontal position (i.e., in surveillance mode), the radar scans the surrounding area and can be used to collect information on flight direction, flight behavior, passage rates, and general speeds of targets (Table 1). When the antenna (or a second antenna, if one is equipped with 2 radars) is placed in the vertical position (i.e., in vertical mode), it can be used to measure flight altitudes (Table 1). Configurations of marine radar antenna also can be modified to measure flight altitudes with a parabolic dish (Cooper et al. 1991, Gauthreaux 1996) or by a horizontal antenna configured on a vertical position (Harmata et al. 1999).

Marine radars have been used in several proposed and operational wind energy facilities in the United States. The principal advantage of these systems over Doppler and tracking radars is that they are relatively inexpensive, are available off the shelf, require little modification or maintenance, have repair personnel readily available worldwide, are dependable and easy to operate, are highly portable (can mount on vehicles, boats, or small platforms on land), have high resolution, and can be modified to collect all radial information by changing their broadcast to a vertical mode.

Largely because of these factors, most research and monitoring studies conducted on birds and bats have been accomplished using marine radar systems (Eastman et al. 1999, Cooper and Day 2004, Mabee and Cooper 2004, Desholm et al. 2006, Mabee et al. 2006*a*). However, like NEXRAD, marine radar generally is not capable of differentiating bird and bat targets. Although it has long been assumed that marine radar can be used to discriminate the presence and flight activity of bird targets (Cooper and Day 2003, Mabee and Cooper 2004, Raphael et al. 2002, Day et al. 2005), researchers have recently acknowledged that images derived from marine radar targets also include bats (Gauthreaux and Livingston 2006, Larkin 2006).

Numerous preconstruction studies have used marine radar to estimate passage rates and altitudinal distributions of migrating targets (Mabee and Cooper 2004, Mabee et al. 2006*a*). Typically, a single radar unit is deployed at a central location on a wind-energy project site to maximize observable airspace for 30–45 days during spring (approx. 1 Apr through late May) and autumn (approx. early Aug through early Oct) migration periods. Results from portable radar units have deployed for a full annual cycle associated with wind-energy projects, and rarely have radar sampling protocols been designed to address specific research hypotheses. Most monitoring studies of airborne targets either proposed or operational wind-energy facilities have deployed marine radar between civil sunset and 0230 hours, assuming that to be the peak period of nocturnal migration for birds on a given night (Gauthreaux 1972, Kerlinger 1995, Mabee et al. 2006*b*).

Observing and assessing to identifying flying animals at night is a major challenge when using radar (Larkin 1991). Differentiating among various targets (e.g., birds, bats, and insects) is central to any biological radar study. However, because flight speeds of bats overlap with flight speeds of passerines (i.e., >6 m/sec; Larkin 1991, Bruderer and Boldt

Figure 6. Composite of three Next-Generation Radar (Weather Surveillance Radar-1988 Doppler) images taken at the Green Mountain airport (KGXY) at 2132 (light), 2135 (medium), and 2139 (dark) CDT on 1 October 1998. All signals that are not biological have been filtered out using software algorithms. Migrants are flying from the northwest (upper left) toward the southeast (lower right). Because of Earth's curvature, the radar beam is sweeping at a greater distance than the actual height of the bird targets. Migrants flying at roughly 2,000 m (6,500 ft) above ground level (AGL) are detectable at a distance of 100 km (62 mi), whereas migrants flying at 500 m (1,600 ft) AGL are detectable at a distance of only 50 km (31 mi). Migrants flying at altitudes lower than 200 m (650 ft) AGL generally are not detectable by the radar beyond a distance of 50 km (31 mi). Range rings are 50 km apart. Data were recorded at the Texas A&M University Agricultural Research and Extension Center at Houston (from Gauthreaux and Belser 2003).

Figure 7. Next Generation Radar (Weather Surveillance Radar-1988 Doppler) images of migration over inland from Hurricane Frances showing regions most affected (red and yellow areas) on south-central Texas, USA, 10–11 September 2004. Migration is observed when extensive areas of nocturnal bird migration are displaced by the storm. It is also possible to identify radio towers for size (from Gauthreaux and Belser 2006). Reflectivity data are from Doppler radar installed at an airport in Houston, Texas (see inset).

2003, A. A. Cooper and R. H. Day, Alaska Biological Research, IABR, Inc.), target differentiation generally is not sensitive to separate bird targets from bat targets based solely on flight speeds. Foraging bats sometimes can be segmented based on their erratic flight patterns. However, migratory bat species and those that do not forage in marine flight behavior while foraging may be indistinguishable from migratory songbirds on radar. Visual verification of a sample of radar returns can be accomplished using night vision devices or cameras. Imaging cameras and observations on the progression of birds versus bats from a site within the area of radar coverage can be related to the radar targets (Gauthreaux 1996, Gauthreaux and Livingston 2006, E. A. Cooper and T. Mabee, MRI, Inc., unpublished data). Use of double-sampling or other extrapolation methods for estimating movement populations (e.g., Program DISTANCE [Anderson et al. 1979]) should be used in such studies to characterize detection biases.

Because insects also are detected with marine radar, it may be necessary to reduce or eliminate the signals from insects if birds, birds and bats are the targets of interest. Reflectance from insects on radar surveillance can be reduced by filtering out all small targets (given that they rarely appear within approximately 500 m of the radar and targets with poor reflectivity (i.e., smaller than most nocturnal migrants), or intermittently in locations with good radar coverage) and by editing data post hoc analysis by creating flying animals tracks (connected targets) with a set speed (Diehl et al. 2003). Application of a discrimination process established in Israel on radar studies that have documented more insects than songbirds, or in an inland, wheeled flight speeds of birds and bats usually are >6 m/sec (Larkin 1991, Bruderer and Boldt 2001, A. A. Cooper and R. H. Day, unpublished data).

Targets reflected from the ground, surrounding vegetation, and other solid objects that interrupt the radar beam typically creates ground clutter echoes that appear on display screens. Ground clutter can obscure targets. Although it can be minimized by elevating the forward edge of the antenna only by using the radar unit in locations that are surrounded directly by low vegetation, hills, and anthropogenic structures. These objects act as radar barriers by shielding the radar from low-lying objects further away from the radar, while increasing only a small amount of ground clutter or

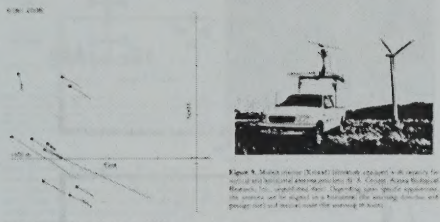


Figure 8. A comparison of 3D paths of flocks of starlings as seen (and measured) with an interferometric tracking radar (left [Hall 1985 at the Bristol National Nursery Unit, recorded 4 December 2006. North is at the top and viewing angle is directly overhead. The start of the flock is marked with a square. The average error (SE of a mean flock) is 0.6 m for the straight paths; straight paths are apply due to flocks that were partly obscured by intervening buildings. For northeastern most flock, which is curvilinear, is a flock descending through a dip, cross-sectional flock. Lidar, see also and measures that flocked, and Kansas State Douglas radar KICK (Lincoln, Illinois), and some of the data were helped record in the vicinity of their origin. (P. B. Lowe, Moses National History Survey, unpublished data).

Figure 9. Mobile marine (Kinetic) ornithology equipped with antenna for radar and horizontal observation units. (J. A. Cooper, Alaska Biological Research, Inc., unpublished data). Depending upon specific equipment, the antenna can be angled in a horizontal (for scanning direction and passage rate) and vertical (for altitude) mode.

this context of the display system (Eastwood 1967, Williamson et al. 1972, Sandals 1993, Cooper et al. 1995, Larkin 2005).

Most frequent deployment of marine radar with other methods (e.g., night-vision devices, thermal infrared imaging, and acoustic detectors) should improve our knowledge of nocturnal species activity and our ability to estimate exposure (i.e., use and risk) at proposed sites, and is likely to improve our ability to distinguish birds from bats during nonmigrating seasons. Species composition and size of birds targeted (identified with marine radar is usually unknown. Thus, the same targets, rather than flocks as individual, is currently used to describe animals detected with marine radar. Occasionally, there are circumstances where a particular species has unique flight patterns that make it possible to identify species-specific targets. For example, nighthawk migrants (*Chordeiles minor*) can usually be identified on radar with a high degree of accuracy at coastal crossing locations (Harper et al. 1995, Harper 1995, 2001, Cooper et al. 2001, 2006), and Hawaiian petrels (*Pterodroma sandwichensis*) and Newell's shearwaters (*Puffinus auricularis newelli*) were identified at three proposed tall wind farm collision sites in Hawaii (Day and Cooper 1995, Cooper and Day 2003, Day et al. 2003). However, such results should be verified with concomitant acoustic and visual observations. For studies using marine radar, independent confirmation of

Table 1. Comparison of flight directions, overall passage rates, and flight altitudes of radar targets at coastal and inland sites in the US. Scores, West Virginia, USA, spring seasons 2003 (n = no. of nights surveyed).

			Comparison site		Coastal site		Time statistics[a]	
Variable	Site	*n*	$\bar{r}$	Dispersion[b]	λ	Dispersion[b]	Z	P
Flight direction (degrees)	Northern	10	193°	4.48	177°	3.76	8.46	0.004
	Southern	23	191°	4.91	205°	4.10	0.26	0.988
	Eastern	13	253°	0.91	178°	3.16	10.87	<0.001
	Western	17	213°	3.75	191°	3.58	7.51	0.019
Passage rate (targets/km/hr)	Northern	17	225	57	288	86	−0.49	0.626
	Southern	23	360	55	339	47	−1.86	0.054
	Eastern	21	54	16	120	13	−3.02	<0.001
	Western	20	107	24	195	40	−3.70	0.007
Flight altitude (m above ground level)	Northern	16	448	38	448	39	−0.52	0.603
	Southern	21	410	31	465	33	−0.37	0.708
	Eastern	16	369	21	422	18	−2.42	0.016
	Western	17	439	29	452	30	−0.91	0.362

[a] Circular Angular (of the distribution about the 0° or the 0° to passage rates and flight altitudes).
[b] Test statistics are for Watson's parametric two-sample test of Equal Median Response (Mardia, Statistics Section), page 280.

Figure 10. Visual confirmation of airborn birds, recorded using infrared scanning thermal camera on 05 April 1999. Note that targets identified as single large segments in images at the upper left (white arrow) could have been those of the larger targets recorded in the adjoining birds (at left) on radar screen and recordings. (Merlin Tuttle Collection, Montreal, Canada, 1999).

species identity is needed if species-specific information is target required.

A current constraint to all marine radar studies is that there are locations where even a skilled and experienced radar operator cannot field a useable sampling site because the zone of primary interest (i.e., as in below exhibit 10) is obscured by shadow zones of hills or areas of ground clutter. One of the most systematic and difficult to learn aspects of using marine radar is the selection of sampling locations. The site chosen has important implications in data quality and comparability among sites. Sites must be chosen where ground clutter and shadow zones do not obscure or limit important portions of the study area. One additional challenge that Kunz's group is finding is using a marine radar on land that can be obscured by a shroud to allow clear surrounding vegetation (Cooper and Blaha 2003). This technique is particularly useful in diversity (hi), heavily wooded sites. To ensure reliable data acquisition, all radar devices must be calibrated before being employed in the field and users must be fully trained in field sampling techniques to ensure reliable data collection.

Case study 1: nocturnal migration at the Altamont Storm wind project—Mabee et al. (2006*a*) used a portable marine radar system in 2003 to collect information on the migration characteristics of nocturnal birds (particularly passerines) during the pre-construction period in the vicinity of the Mt. Storm Wind Power Project in West Virginia. The objectives were to (1) collect and compare information on flight directions, migration passage rates, and flight altitudes of nocturnal migrants at multiple sites near or within the proposed development, (2) determine if nocturnal bird migration occurred as a broad front, and (3) determine if nocturnal migrants follow the Allegheny Front ridgeline within the proposed project area.

The study design involved using one mobile radar at a second site (sampling approx 8 fortnights) and a second radar unit that could be moved between 4 secondary sites (i.e., northern, southern, eastern, or western locations) and sampled approximately 2.5–3 hours per site per night. All paired comparisons were made with concurrent data from the control site. Observer assignments and starting locations of the second mobile radar laboratory were varied systematically to eliminate bias among sites and observers. Flight directions and altitudes at sites among or near the subproject area was collected from each radar, but flight-path deflection in passage rates were obtained among sites of these sampling sites (Table 1). These data demonstrated that nocturnal migrants (mostly songbirds) follow the Allegheny Front ridgeline (Mabee et al. 2006*b*).

Case study 2: nocturnal bird migration at the Stateline wind project—Situated in a region viewed (by bird agencies) and guiding land, the Stateline wind energy facility (situated at the Vista, V-47 wind turbine (Danish Wind Technology, Klitgaard, Denmark) rated at 660 kW each, with 272 turbines located in Walla Walla County, Washington, USA, and 181 turbines located in Umatilla County, Oregon, USA. Several studies were conducted by Kerlinger and Cooper (2004) to meet the permit requirements in Oregon (state permitting process) and in Washington (county permitting process). After the original permits were granted, the developer (Florida Power and Light Energy [FPLE]) sought an amendment of its county permit in Washington to build things further to the north and down to the Columbia River. Based on negotiations with the Rice Mountain Audubon Society, a condition of permit approval was granted that required FPLE to support cause nocturnal studies. The results of this research were evaluated by a technical advisory committee to determine whether the risk associated with wind turbines in this area were tolerable.

The specific hypotheses tested were that the mean flight altitudes and mean night rates were the same in the area where the wind turbines were proposed compared to the altitudes and passage rates observed at a control area to the south, many from the Columbia River. To test this hypothesis, 2 marine radar units were used concurrently during 2 autumn and one spring period for a total of 200 night per radar (Mabee and Cooper 2004). Mean passage rates and flight altitudes were compared between the 2 locations using the non-parametric Watsons's circular-rank test (Zar 1999:617) and Kuiper's difference, however mean passage rates and flight altitudes were likewise used between the 2 locations (Tables 2, 3).

Emerging radar technologies and applications—The National Aeronautics and Space Administration recently developed high-resolution, polarimetric, weather radar (NPOL) that promises to be more useful for studying environmental birds and bats than NEXRAD. Because of its high resolution, NPOL can be used to collect data on individual targets and potentially discriminate between insects, birds, and bats. More recent developments of Collaborative Adaptive Sensing of the Atmosphere (University of Massachusetts, Amherst, MA) have developed a mesh of Distributed Collaborative Adaptive Sensing networks that will sample the atmosphere at altitudes below those typically detected with NEXRAD. Use of data

Table 2. Mean nocturnal speed of passerine migrants (*n* = 161) of all species observed during short-range radar scanning (2.5 min) at Black Grade, Washington, USA, and Wasatch Ridge area, Oregon, USA, during autumn 2006 using 360° and 4 north 2006 (*n* = no. of concurrent overflight nights).

			Movement rate		Welcoxon signed-ranks test		
Season	Location	$\bar{x}$	SE	N	Z	N	P
Autumn 2006	Black Grade	29.1	4.2	21			
	Wasatch Ridge	15.1	1.7	23	−3.06	15	0.002
Spring 2007	Black Grade	13.2	1.2	42			
	Wasatch Ridge	19.8	2.3	42	−3.2	41	0.01
Autumn 2007	Black Grade	14.4	1.6	31			
	Wasatch Ridge	20.8	3.4	31	−2.19	24	0.03

generated using Multiple Antenna Profiler Radar (MAPR) also holds considerable promise for characterizing temporal and elevational profiles of insects, birds, and bats during clear air periods. A MAPR is an advanced radar system being developed at the National Center for Atmospheric Research and Earth Observing Laboratory to make wind wind measurements of targets within the Earth's boundary layer (Fig. 10). These and other recent radar developments (NRC 2005, Larkin 2005) continue to advance future research on the behavior and activity of airborne organisms, including those in the vicinity of wind energy facilities (B. Kelly, DeTect, Inc., personal communication).

Acoustic Monitoring of Birds

Ornithologists have long used acoustic monitoring of nocturnal migrants to better understand bird migration (Lanyon 1956, Bull 1964, Graber and Graber 1963, Balcomb 1967, Thake 1981). With the publication of spectrum (enhanced) flight calls accompanied by experts (Evans and O'Brien 2002), the practice of listening to flight calls of birds at night has widened from being an academic to a practical method of monitoring bird migration (reviewed in Farnsworth 2005).

Because nocturnal calls of passerines (songbirds) are heard most frequently, research has centered on this group (Pettingill 1943, Sutton 1948, Farnsworth 2005). However, birds such as upland sandpiper (*Bartramia longicauda*) and woodcock (*Scolopax minor*) also produce calls at night.

Table 3. Autumn nocturnal mean seasonal flight altitudes (in meters above local ground level [= AGL]) of migrants observed during vertical radar scanning (2.5-min scans) at Black Grade, Washington, USA, and Wasatch Ridge, Oregon, USA, during spring and autumn 2007. Mean elevation values (*x*) and number of targets (*n*) per 2.5-min scans are based on the number of sampling nights (*n*). Test statistics are Mann–Whitney *U*-test and Wilcoxon signed-rank (*Z*) values.

		Flight altitudes			Test results			
Season	Location	$\bar{x}$	SE	*n*/*n*	*U*	*Z*	Angle	*P*
Autumn 2006								
Spring 2007	Black Grade	1074	4.1	8,286				
	Wasatch Ridge	928.1	4.8	8,321	18.5		90	0.04
Autumn 2007	Black Grade	663.4	2.6	2,175				
	Wasatch Ridge	620.6	2.8	3,103		−2.05	44	0.03
Interseasonal								
Spring 2007	Black Grade	414.8	2.1					
Autumn 2007	Black Grade	663.4	2.6		40.5		90	<0.01
Spring 2007	Wasatch Ridge	928.1	4.8					
Autumn 2007	Wasatch Ridge	620.6	2.8		4.0		90	0.04

* Over 150–1500 annual radar-observed hectares since Spring 2003, almost 2 radar-recorded consecutive during autumn 2007.

Experience requirements—Any outdoor acoustic study poses challenges for remotes and cables, including moisture, vandalism, lightning, and physical abuse. Enclosure of equipment such as masts, towers, and tents required to operate, stabilize, and shelter a mast, microphone array, equipment for an acoustic study of birds involves the following:

More than one microphone is necessary to obtain information on location and flight altitude. An ideal microphone offers good omnidirectional (centered generated by slight changes in sensitivity), one internal noise level (e.g., low hum, slow noise, and crackle under the electronic environment), resistance to extremes of moisture and temperature, and affordable cost. Sensitivity quality is desired more in one direction than others. A good electronic microphone (which varies by cost and practicality) will greatly amplify sounds coming on its axis and be less sensitive to sounds from other directions. Any microphone used for bird flight calls should be sensitive to sounds ranging from about 20 kilohertz (kHz) to 15 kHz, preferably lower. Preamplifiers are placed close to microphones to amplify weak electrical signals from the microphone to a level that can be transmitted to a recording device without distortion. Preamplifiers require power to operate, and most will function for an entire night or longer on a set of small batteries.

Unless directionality is needed, good weather-proofed cables are adequate and optimal, for outdoor work. A complete set of environmental cables and connectors over a night's worth

of data. Alternatively, an elevated acoustic sensor (microphone + preamplifier) might be used to represent a radio signal to a nearby receiving station on the ground. Digital devices such as high-density computer disks are an attractive solution for the formerly used audiotape or video home system (VHS) cassettes. Changing batteries and cleaning and swapping recording devices are another substantial personnel costs if many units are deployed. Power-conservation modes may have first power available from wind turbines.

In field applications, the most serious problem will often be the masking of flight calls by ambient noise, including wind noise, insects, water noise, and human sounds and noise from the environment (traffic). Because researchers prefer to block spurious reflections into the microphone, the location of any sound barrier should be made of a nonreflective surface. Hay bales and closed-cell foam are excellent for absorbing extraneous sounds. Because most flight calls of interest are produced at moderately high frequencies (>4.5 kHz), sound barriers should be nearly as tight as possible since low frequencies pass through small openings. Windscreens, open-cell foam is often used to reduce wind noise when sound manufacturers are exposed to wind.

Acoustic identification of calling migrants—Early studies regarded species distributions of flight calls at night to be more or less known. More recently, extensive fieldwork has enabled researchers to identify many individual species and a few broader groups of similar sounding species, but confidence in identification largely depends on the skill of the individuals conducting the studies. Whereas some nocturnal flight calls of birds are easy to identify because they are distinctive as well-known and distinctive ones heard during the day, discriminating groups of species with flight calls that are similar sounding to the ear and to sonagraphs (or sonograms a is major challenge that calls for more sophisticated analyses of flight calls beyond detailed changes in acoustic frequency and harmonics over time. For example, song recognition to some Carduous finches appears to be accomplished largely by using the sound frequency (pitch) ratio of different notes to each other (Weary et al. 1998).

The most field studies relying on acoustic monitoring of bird calls, an important next question is whether an expert listener will spend hundreds of hours listening to and classifying recordings or if sophisticated voice-recognition software will be soon to speed or perhaps assume that role (Larkin et al. 2002). If proper design considers a computer-human analysis of nocturnal flight calls, such a potential application is technologically realized in the present time. Recent developments in recognition of animal vocalizations, particularly bird song and cetacean sounds, may in the future be adapted for classification of bird calls made in flight (NRC 2005). However, computer methods exist to sort flight calls also rely on expert-system algorithms and the experts who develop and refine them. Flight calls that are readily identifiable with confidence include some species of

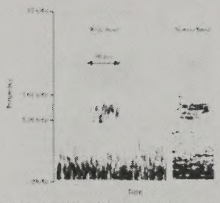
conservation concern (Russell et al. 1998), especially species whose populations are declining.

Documenting nocturnal migrants—Quantification of flight calls of migrating songbirds from acoustic recordings has suffered partly because, even when one can enumerate the calls from various avian bird species, the volume of airspace sampled is difficult to estimate for calls of poorly known intensity (i.e., loud-soft). However, if researchers concerned with wind power and wildlife issues are using a good acoustic recording system know that flight calls are within the interrogation zone, they can state that these calls are at least about 125 m above the ground for a medium, medium, widely-field avoid system. As such distances, caution (speaking) on the atmospheric absorption should be important. Assuming that ambient noise is acceptable, such systems should provide good signal-to-noise ratios, and careful measurements of the directionality of the microphones should permit calculations of the sampling volume. If the passage rate of birds over or across the microphones and within the useful range of targets can also be measured (e.g., using marine radar), and calls per hour per area per time can be estimated.

The numbers of calls vary over the course of a night. Variables include temporal variation from the ground for birds (get to lose bit), numbers of migrants of different species, where a microphone at different times, time varying volumes of large bodies of water from which no bird flocks take flight at sunset (W. R. Evans, OldBird, Inc., personal communication), and temporal variation in the rate of calling of individual birds. Like other methods of monitoring nocturnal migrant birds, there is also high variability in the number of calls heard among nights so that sampling must be conducted over an extended period to achieve confidence in the results (Evans 2000, Hobe et al. 2002). Not all migrating passerines produce calls at night, and there may be only one call when they pass over a microphone.

To reliably estimate bird abundance or more ambitious, certain numbers flying past wind turbines or potential wind turbines, one must know many birds, not just flight calls (Lensky and Nevenzal 1955). How often do birds of each species call? What is the relationship between the number of animals and the number of calls (when some animals are silent) and calls per animal (when animals vocalize more than once in the microphone range)? Little is known about the calling rate of migrating birds at night, and no biological theory exists upon to formulate an hypothesis. Some anatomic report behavioral tracking of a series of songbirds, some of the dark, as if a single migrant was calling at intervals passing overhead, before up that multiple calls from one bird do occur. By contrast, radar data show many more targets aloft than can been from the ground, thus, most birds (including whole groups of species) entered in Farnsworth 2005) apparently do not regularly produce flight calls.

This conclusion is reinforced by recent radar work showing that, in some instances, numbers of radar targets are



Time

Figure 11. Sonic spectrogram (oscillogram) of typical nocturnal upward migration of 22 September 1954 at Millbrook, New York, USA (R. F. Lucas, Bowles Natural History Survey, unpublished data).

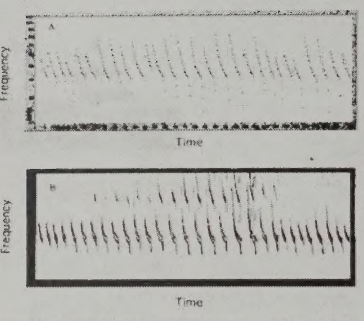


Figure 12. Sonograms of a wind turbine survey. Bioacoustic monitoring (using passive recording bat detection equipment at Meridian Lamont, near Elkton, CA, USA, 15 July 2008). Bats passing during one night are recorded with zero-crossing data reduction in the context of a wind turbine and Analook software (Titley Electronics, Ballina, New South Wales, Australia). (A) and (B) spectrograms were recording amplitude distributions using a Pettersson ultrasonic Batdetector M5 (Uppsala, Sweden) and AnalookW software (Chandler, Arcadia, CA). (B) In each sonogram the sound force between only two frequencies is shown, typically the audible frequency generated as a sonic signal with the frequency scale mapped proportionately on the y-axis (vertical, with Analook, the Analook processing software) (J. Szewczak, Humboldt State University, unpublished data).

sonicated empirically such numbers of recorded flight calls (Evans 2000, Larkin et al. 2002, Farnsworth et al. 2004), indicating that flight calls may provide an index of migratory intensity or bias in some circumstances. However, the rates for such correlations are not to be determined (Larkin et al. 2002) and currently there is no way to know if the finding can be applied generally or only in some situations.

Flight animals—birds at night typically are not vulnerable to wind turbines unless they are in the height range of the rotor-swept zone, or when they are descending to ground level or taking off from the ground. Migrating birds are cruising flight often fly higher than the heights of existing wind turbine rotors, and nocturnal aerial displays of birds often do not reach rotor height, with possible exceptions during inclement weather, take-offs, and landings. Bats make fly upward or downward toward wind turbines, but migrating birds do not seem to be attracted to them. However, assessment of flight altitude (agl) is challenging at best. It is not possible to localize a sound using a single microphone. A single directional microphone is even poorer because the source of a sound that registers loudly may be on the axis of high sensitivity or a great distance off the axis but still nearby.

More than one microphone and an accurate multi-channel recording or registering device can help detect the calls of flying birds (Evans 2000). If the signal to noise ratio is adequate, the difference in arrival latencies of a flight call at different microphones separated in space can help locate the bird making the call. For locating a vocal to N dimensions, one needs high quality sounds on N+1 microphones. Although marking a distinctive feature of a single call on real-time sonograms and measuring latencies the voices is often accurate enough, cross-correlation among several identical microphones generally produces better latency measures and better estimates of height, especially when a call contains no distinctive features.

A variant of this technique was used to measure, on in-rush cross migration, altitudes of birds flying over a prospective wind-energy facility in Nebraska, USA (Howe et al. 2002). Investigators used differences in sound arrival times at 3 microphones vertically aligned at different altitudes on an open framework tower, generating conclusions about the altitudes of the calling birds.

Creative and cost-effective variations on the multi-microphone approach include measuring the Doppler effect at each microphone, suspending additional microphones on aerial platforms (e.g., kite balloons), and using crossed-calibrated directional microphones. For example, consider 2 directional microphones both positioned within the rotor sweep zone, spaced very closer the other axis aimed horizontally in the same direction. Any small flight call entering approximately horizontally at the 2 microphones (depending on their spatial separation) should be from a bird at rotor height, either relatively close to the microphone or in the direction to which they are aimed.

Researchers using single microphones often report an estimated maximum effective range of the microphone for sounds such as 'tick' calls, but fail to distinguish among birds flying above, within, or below rotor height. In this case, the acoustic recordings are of little value except to provide a partial species list of which kinds of birds are overhead, which birds vocalized on a given night, and to what degree they vocalize. Moreover, flight calls of different species contain sound frequencies that attenuate at very different rates in the atmosphere and, thus, are audible at different maximum distances (see below), and rates of calling are sometimes related to local events and perhaps diurnal cycles.

It is nearly impossible to interpret data gathered using acoustic recordings alone, in part because the biological context of the calls is open to question. Vocalizations are usually presumed to have a role in function (Marler 2004), but nocturnal passerines in North America are not thought to fly in flocks the way birds fly in the daytime (Gauthreaux 1982, Lin & Yen 2006, but see Moore 1990), and communication with birds on the ground is not of the question. A plausible hypothesis has even been made for a height-limiting function of flight calls in echolocation of the ground (Lowery and Newman 1955, Griffin and Buettner 1978). (This hypothesis should predict frequent calling when birds pass flies over a subjects.) Finally, it is not known whether sounds made by surviving wind turbines interfere with recording the calls made by nocturnally migrating birds.

One example sounded call guide—a sound spectrogram (sonogram) from a flight call was recorded on 22 September 1954 using a 2 Foot sound-activated condenser microphone and Nagra analog tape deck (Fig. 11). Ambient noise lies mainly below 2 kHz and the call is in the mid-range of frequencies of calls of migrant birds. The fuzzy appearance indicates a marginal signal-to-noise ratio. Rather than a clear synthesis example of a common species, this sonogram is representative of many ambiguous flight

species (Nemeth et al. 2008). For many species, however, obtaining such data requires that bats be captured. Although captures are difficult or impractical to achieve in open environments at the heights of rotor-swept zone. Acoustic, visual, and radar observation methods provide an alternative to capture methods because the observer do not interfere with the normal behavior and flight trajectories of bats. In addition, compared with visual methods and radar, acoustic monitoring methods better support long-term monitoring because of their lower data burden and ability to proceed reasonably without the need for operating personnel (Reynolds 2006). However, questions remain as to whether migrating bats echolocate continuously while they are flying (Van Gelder 1956, Griffin 1970, Johnson et al. 2003). Thus, methods such as thermal infrared imaging or other night-vision methods should be used simultaneously with acoustic monitoring during expected times of migration until this issue can be resolved.

Acoustic detection and monitoring of bats begins with acquisition of a signal using a microphone sensitive to ultrasonic frequencies. A microphone and detector records the spaces having a frequency response up to 150 kHz suitable current of North American bat species. The acquired ultrasonic signals must then be translated into a usable form. This can be accomplished by transforming ultrasonic signals into humanly audible tones (for manual monitoring), or by directly recording the digital data for storage and processing. Digital data can then be transferred and integrated by one of 3 primary approaches of increasing signal complexity: 1) heterodyne, 2) frequency division, including zero-crossing, and 3) full-spectrum, including time expansion (Table 4).

Heterodyning reduces the frequencies of the signal from the air sample one by making it with a synthesized tone (Andersen and Miller 1977). This mixing produces an output signal with a frequency based on the frequency difference between the 2 mixed signals (i.e., the beat frequency). The frequency of an artificially generated signal is set by the user by tuning the detector to listen for calls at a particular frequency. Heterodyne units are the simplest ultrasound detector to

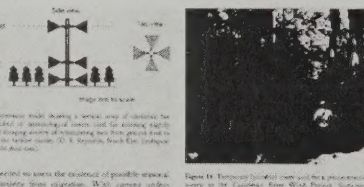


Figure 14. Schematic radar showing a vertical array of elevation bat detectors installed at monitoring towers used for existing night migration and foraging studies of songbirds and bats from ground level to the height of the turbine rotors. (D. S. Reynolds, Beach Environmental Services, Canada, Ohio, USA).

Figure 15. Temporary bat-relief tower used for a preconstruction acoustic survey in the Cumberland River Wind Project, Scott and Clinton Counties, Tennessee, USA. Although the tower extends to the level rotor-swept heights, the foraging echolocation activity was rarely detected accurately when the detector is placed for conservation viewing edge below and near ground level. (Photograph by D. S. Reynolds, Beach Environmental Services, unpublished data).

would be excited to assess the existence of possible seasonal pattern of activity from migration. With current understanding of bat biology, it is difficult to justify any attempt to reconcile that the absence of bat activity on one or a few nights of recordings (or might be typical of a preconstruction survey) supports the appropriateness of a given site for wind facility development.

Ground detector installations. Detectors positioned at ground level capture distant bats at the outer height of modern utility-scale wind turbines. Because bat densities measured on data are thought to result mostly from those active by various causes (Hayes et al. 2008), it is essential to deploy detectors at the height of the rotor-swept zone to effectively assess potential flight activity although the relevant airspace. The height will vary according to the size of the turbine, but where possible, detectors should be deployed 2–10 m above the ground to adequately assess flight activity of temperate insectivorous bats. Where possible, detectors should be placed at existing meteorological towers, which are typically available at both preconstruction and postconstruction wind energy facilities (Reynolds 2006). In the absence of such structures, temporary towers can be employed (Fig. 14). In addition to detectors placed at rotor-height, such monitoring must be devised who have a detector placed near ground level (2–4 m tall) to optimize the estimate of airspace for detecting bats, because at this height the acoustic snapshot will reach ground level and also detect flying bats flying above it, at least to the range limits of detection. A third detector deployed at an intermediate height would more effectively cover the vertical distribution of nocturnal bat activity. Ground-level detection will point in assessing bat presence, and rotor-height detectors will assess potential interactions of bats with rotors (Reynolds 2006).

A lack of documented bat activity at rotor-height during preconstruction surveys does not preclude risk of collision, because bats may be attracted to a site once turbines are constructed (Kerlinger 2006, Arnett et al. 2007, Arnett et al. 2008). Even surveys at ground level may only serve to indicate presence of bats that could potentially become exposed to the heights of operating wind turbines. Alternatively, changes in vegetation cover and conditions

calls even when recorded on systems. High quality equipment. This call lacks distinctive features useful for measuring time of arrival at the microphone so for determining the species of bird with any degree of certainty. A thorough discussion of call quality is treated by Evans (1994).

Case study: pre- and postconstruction monitoring.—Preconstruction studies at wind turbine facilities (Evans 2000, Howe et al. 2002) and postconstruction studies in Nebraska and New York (Evans 2000) have employed multiple microphones to measure the altitude of passing migrants. Both flying ground tall communication towers or exercise flights are often exposed to show a high rate of calling (Avery et al. 1976). Thus, postconstruction studies of calling birds must allow for the possibility that wind turbines attract calling birds, in which case calls may indicate increased vulnerability to collision with the tower structure or blades rather than a record of passing birds. Direct observation of bird flight paths, for example, from detailed tracking radar data, can study or rule out this possibility.

Acoustic Monitoring of Echolocating Bats

All North American bats emit regular pulses of vocalizations during flight that create echoes used for navigation and for detecting and pursuing prey. Biological sonar, or echolocation, provides important acoustic information that can be detected and used to indicate the presence of bats, and in many cases to identify species. Except for a few species of bats that emit audible (to humans) echolocation calls, most bats vocalize at ultrasonic frequencies (well above the range of human hearing, >20 kHz). Various devices are available for detecting and converting ultrasonic calls of bats into audible sounds or data that can be captured on a tape recorder or a computer hard drive. However, the rapid aerial attenuation of high-frequency calls (Griffin 1971) can bias detection rates toward species that produce low-frequency sound. Bats can also generate sound intensities as high as 135 dB, setting the loudest source levels recorded for any animal (Holderied et al. 2005). Thus sensitive many species detectable at ranges >30 m.

High intensity of bats.—Because different bat species vary in their loudness (i.e., intensity), those that vocalize at low intensities will be less detectable and thus, introduce a near-overall bias against species that produce low-intensity echolocation calls (Griffin 1958, Fenton et al. 1993, Fullard and Dawson 1997). Low-intensity echolocators (e.g., *Corynorhinus* spp.) or so-called whispering bats, have a relative effective radius of detection and, thus, may be missed during acoustic surveys unless they be close to an ultrasonic detector (within 3–5 m for some species). However, this limited detection range also provides an advantage of increased spatial resolution (e.g., distinguishing between bats at ground level vs. those at some height) in acoustic monitoring programs with detectors placed at these different 2D above the ground (Arnett et al. 2006, Reynolds 2006).

Bat passes.—Acoustic detection of bats provides a practical and effective means to measure bat presence, activity, and relative abundance (Fig. 12). We emphasize relative abundance, because, as with monitoring bird calls, surveys estimate monitoring methodology cannot determine the number of individual bats detected, as can only record counts of detections, termed bat passes, of bats that enter the volume of airspace within detection range. A bat pass is defined as a sequence of >2 echolocation calls, with each sequence, or pass, separated by >1 second (Fenton 1970, Thomas and West 1989, Hayes 1997). Bat passes are commonly used as an index of activity or abundance, but it is important to understand that they do not indicate the number of individuals. One hundred different bats of the same species passing once an ultrasonic detector or generally indistinguishable from a single bat that returns to pass a detector 100 times. Thus, the data from monitoring echolocation calls of bats can only provide population indices or statistical proxies of relative activity or abundance (Hayes 2000).

Quantifying bat passes as an index of abundance can provide guidance as to index of bat occurrence, and with an appropriate study design these data can be analyzed statistically and meaningfully (Parsons and Szewczak 2009). Recorded levels of activity at any site are not necessarily proportional to abundance because (1) of differential detectability of bat species, 2) all bat species may not call at the same rate (e.g., *Myotis* vs. *Lasiurus*), 3) all individuals within a given species may not call at the same rates (e.g., migrating vs. foraging), 4) some species may remain out of detection range of a detector despite their presence, 5) variable foraging behavior of some species (e.g., a detector deployed in the open is likely to pass bats that forage along the edge of vegetation), 6) weather and environmental factors, and 7) temporal variations in activity. The latter factor can vary on a scale of days as bats follow local insect activity or also in response to during migration.

Bats exhibit a dynamic response to the landscape where they typically forage at several different locations each night (Kunz et al. 2007). Widely ranging movements by bat passes can vary significantly at any one location so that a single night of data will not statistically represent the overall trend of bat activity at that location (Hayes 1997, Gannon et al. 2003). Beyond assessing the presence of a bat, detailed identification to species requires even longer survey efforts, typically on the order of months (Murray and Hayes 2003). Longer-term temporal variations due to seasonal movements of bats, such as migration, are of vital concern because of the documented relationship between bat fatalities at wind-energy facilities during seasonal migration (Johnson et al. 2004, Arnett et al. 2008). For each of these considerations, the best strategy for assessing potential interactions between bats and wind turbines is to implement a long-term acoustic monitoring program, best conducted throughout an entire annual cycle (Apr through Nov in temperate North America) to account for all seasonal variables and ideally covering 3–5 years to assess bats within year and inter-annual variability.

Acoustic monitoring generally cannot provide information on age, sex, or reproductive conditions of bats, although recent evidence suggests that this may be possible for some

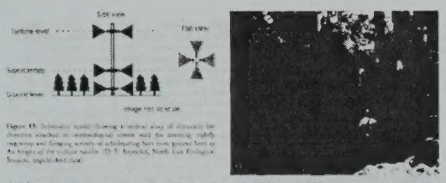


Figure 13. Schematic model showing a minimum array of detectors for detection studies at meteorological towers used for assessing nightly migratory bat foraging activity of echolocating bats from ground level to the height of the turbine nacelle (D. S. Reynolds, North Line Ecological Research, unpublished data).

Figure 14. Top-down (ventral) view and for a passive acoustic detection survey in the Cumberland River Wind Project, Somerset County, Pennsylvania, USA. Although the study was limited to the low rotor-sweep height, bat foraging behavior and activity will likely change markedly when the tower is fitted for construction, causing edge-habitat and open-space effects that is not present during the preconstruction period (E. K. Arnett, Bat Conservation International, unpublished data).

sound) be needed to assess the avoidance of possible seasonal phases of activity (bats migrating). With current understanding of bat biology, it is difficult and largely indefensible to conclude that the absence of bat activity on one or a few nights of recordings (as might be typical of a preconstruction survey) supports the appropriateness of a given site for wind facility development.

Given their limitations, ultrasonic detectors placed at ground level cannot detect bats at the rotor height of modern utility-scale wind turbines. Because bat fatalities recorded to date are thought to result mostly from direct injuries to turbine rotors (Horn et al. 2008), it is essential to deploy detectors at the height of the rotor-swept area to effectively assess potential flight activities through the relevant airspace. This height will vary according to the size of the turbine, but where possible, detectors should be deployed ≥30 m above the ground to adequately assess flight activity at rotor-swept encroachment risks. Where possible, detectors should be placed at existing meteorological towers, which are typically available at both preconstruction and postconstruction wind-energy facilities (Reynolds 2006). In the absence of such structures, temporary towers can be deployed (Fig. 14). In addition to detectors placed at rotor-height, each monitoring location should also have a detector placed near ground level (2–3 m) still to optimize the subject of concern for detecting bats, because at this height the detector operations will reach ground level and also detect flying bats flying above it at least in the range limits of detection. A third detector deployed at an intermediate height would more effectively cover the vertical distribution of exposed bat activity. Ground-level detectors will assist in assessing site generation, and canopy-height detection will assess potential interactions of bats with vanes (Reynolds 2006).

A lack of documented bat activity at rotor height during preconstruction surveys does not preclude risk of collision; because bats may be attracted to a site once turbines are constructed (Arnett 2005, Kunz et al. 2007, Arnett et al. 2008). Thus, surveys at ground level may only serve to indicate presence of bats that could potentially become attracted to the height of operating wind turbines. Alternatively, changes in vegetation cover and conditions since preconstruction to postconstruction may also affect the heights at which bats fly, thus leading to elude bats finding, encountering, or migrating through an area, and potentially increasing encounter risk with turbine rotors.

Reynolds (2006) deployed a vertical array of acoustic detectors on meteorological towers that recorded continuously for several nights during the spring migration period at a proposed wind facility in New York. More recently, 2 other studies have deployed detectors at multiple levels on the available meteorological towers and extensively assessed bat activity for several months (Arnett et al. 2006, Rodrigues et al. 2006). Establishing vertical arrays of detectors to allow sampling near or within the rotor-swept area is desirable and is recommended by all entities requesting such information for preconstruction studies.

Unfortunately, only a few (e.g., 5–6) meteorological towers are available at most wind energy projects, which severely limit the ability to distribute sampling points at vertical arrays in any given project. The number of sampling points required to achieve a desired level of precision for describing activity and species composition at a proposed site is currently unknown, owing in part to the relatively small datasets gathered to date. A preliminary analysis of data gathered at meteorological towers and single-mounted portable towers in Pennsylvania (Arnett et al. 2006) suggests that 2 or 3 towers typically combined with detectors during preconstruction studies may fail to adequately represent bat activity on a given site (M. Ehrett, Oregon State University, unpublished data). Moreover, the number of towers required to reliably predict postconstruction fatality remains to be determined and likely will vary depending on the size of the proposed development.

Despite its limitations, acoustic detection of bats provides a practical and effective means to assess relative activity of bats among seasons has remained an elusive goal for many bat researchers. In contrast to birds, whose calls have undergone selection to be different from those of other species, echolocating bats use their calls for acquiring information from the environment (including size, shape, and wing flutter), and as general natural selection has operated to optimize prey detection. For some syntopic species (e.g., *Myotis* and *Eptesicus–Lasionycteris*), there appears to be little sensitive prominent to statistically differentiate among species. Based on current publications, many species appear to lack obvious discriminating differences in their vocal characteristics (Estes 1998, Barclay 1998, Szewczak 2004, Parsons and Szewczak 2008). As an additional complication, bats exhibit considerable plasticity in their vocalizations and can produce calls outside that overlap in many parameters with those emitted by other species (Thomas et al. 1987, Obrist 1995, Barclay 1999).

Despite these challenges and limitations, the basic time-frequency characteristics recorded by zero-crossing (Anabat) processed data generally provides sufficient information to recognize reasonably functional species (e.g., eastern red bat [*Lasiurus borealis*] and hoary bat [*Lasiurus cinereus*]) and at the minimum place bats into groups having similar acoustic characteristics (e.g., big brown [*Eptesicus fuscus*] and silver-haired bats [*Lasionycteris noctivagans*], and *Myotis* species, respectively).

High-resolution microphone processed from full-spectrum data reveal subtle attributes and significantly improve species discrimination of bat echolocation calls (Fig. 15; Parsons and Jones 2000, Preston et al. 2003, Szewczak 2004). The greater information content inherent in full-spectrum data also supports objective means of discrimination using automated computer processing. Parsons and Jones (2000) developed an artificial neural network that correctly identified 87% of the 12 most commonly echoed bat species in the United Kingdom, including a suite of *Myotis* species, compared with the performance of discriminant function analysis on the same data set that gave a correct classification rate of 79%. More recent research applying increased variation of acoustic properties and ensembles of computer learning systems have increased the correct automated classification rate of this same data set to 97% (S. Parsons, University of Auckland, personal communication). Systems applying this methodology for North American bats are currently under development. Our understanding of bat behavior continues to improve with advances in detection technology. For example, ultrasonic microphone arrays and video images could be used to determine the 3-dimensional use of space by bats around turbines (Hollerand and von Helversen 2003, Hollerand et al. 2005).

Evaluating bat fatalities.—The preliminary results of an ongoing postconstruction survey by Arnett et al. (2006) provides the first example of a thoroughly designed study involving acoustic monitoring. The study was initiated in mid-summer 2005 as part of a 3-year study to determine patterns of bat activity and evaluate the use of acoustic

Table 1. Fatality and bat activity rates at 5 wind energy facilities in the United States.

Study area	Duration (dates of study)[a]	Bat mortality (bat fatalities/turbine/night)	Bat activity (bat detector nights)	Fatality (bat detector nights)	Source
Mountaineer, WV	21 Aug–15 Sep 2004	19.81	14.2	35	T. H. Kunz, Bat Conservation International, unpublished data
Buffalo Mountain, TN	1 Sep 2000–30 Sep 2003	47.8	13.7	248	Fiedler 2004
Top of Iowa, IA	15 Mar–15 Dec 2003, 2004	11.2	16.9	42	Jain 2005
Buffalo Ridge, MN	15 Mar–15 Nov 2001, 2002	2.3	2.1	270	Johnson et al. 2003
Foote Creek Rim, WY	1 Nov 1998–31 Dec 2002	1.8	2.0	39	Young 2003

[a] Sample periods and duration of sampling varied among studies, with no fatality measurements conducted in the winter months at some projects.

monitoring to predict fatalities of bats at a proposed wind-energy facility in south-central Pennsylvania. The primary objectives were to 1) determine level and parameters of activity of different species groups of bats using the proposed wind facility prior to and after construction of turbines, 2) evaluate relationships between bat activity, weather, and other environmental variables, and 3) determine if indices of preconstruction bat activity can be used to predict postconstruction bat fatalities.

The study sites relied on long-term recordings of echolocation calls using Anabat zero-crossing ultrasonic detectors (Fig. 17) with real-recording among mist-net sessions and full-spectrum acoustic recording. The study used a rotation of temporarily towers to sample at a large number of proposed turbine sites. Results from the study will be combined with numerous studies currently underway throughout North America that have designed acoustic estimates on seasonally preconstruction bat activity and will later conduct postconstruction searches to estimate bat fatality. The analyses will evaluate possible relationships between bat activity and postconstruction fatality rates from each facility to determine if fatalities can be predicted from preconstruction acoustic data and at what level of precision.

Bat fatality and activity indices–offline studies. Data reported on postconstruction surveys using Anabat zero-crossing ultrasonic detectors to support and interpret carcass surveys at operating wind energy facilities (Table 1). The estimated total number of bat calls per night for each site was moderately correlated with estimated fatalities per turbine per year ($r = 0.78$). However, there are several limitations of this type of analysis. The data on echolocation calls recorded at these studies did not distinguish among species. Moreover, echolocation calls were recorded at different altitudes at some sites and only at ground level at others. In addition, echolocation call data were all collected after the wind-energy facilities were constructed. Thus, it is unclear whether preconstruction call data would have shown a different pattern. If modifications to forested habitats (thereby creating fewer cluttered) or the turbines themselves attract bats, the relationship between preconstruction call rates and fatality rates may not exist or may not be as strong.

Radiotelemetry

Radiotracking (following attached) or radiotelemetry (transmitting other information in addition to an audio signal with miniature VHF transmitters (Millspaugh and Marshall 2001, Fiedler et al. 2007) has the potential to follow the dispersal and migratory paths of known individual birds or bats for long distances. Radiotracking was pioneered with birds weighing about 15 g in the 1960s (Gruber 1965, Cochran et al. 1967) and has been used to 1) study the flight of nocturnal passerine migrants with respect to wind and land features (Cochran and Wikelski 2005), 2) measure birds for measurements of metabolic rate during flight (Wikelski et al. 2003), and 3) examine avian heart information (Bishl and Larkin 1990). Where ground-tracking is important (e.g., nightly movements regional), radiotracking from small towers holds promise for determining nightly dispersal patterns and migratory routes of some species. Radiotracking of small bats and birds weighing >15 g over long distances is currently limited by the size of radiotransmitters (e.g., type of signal, and signal strength and duration, which are limited by battery size). A rule of thumb for radiotracking birds and bats is that radiotransmitters should not exceed 5% of the animal's body mass (Aldridge and Brigham 1988).

Global Positioning System. GPS receivers and transmitters used with Argos satellites are currently too large to be used on passerine birds and small bats (Aldridge and Brigham 1988, Cryan and Diehl 2008). Although radiotracking has been widely employed to follow movements of bats (e.g., Williams and Williams 1970, Williamson and Bradbury 1980, Barclay et al. 2002, Lacki et al. 2007, Arnett et al. 2008), we are unaware of published accounts of long-range migrations of small, migratory bats determined by radiotracking. Large Old World fruit bats (*Pteropus* spp.) have been radiotracked long distances by aircraft (Clay 1941, Spencer et al. 1992), and by satellite (Cloud and Engbrecht 2006), and ongoing studies in New York and Pennsylvania have been successfully radiotracking Indiana bats (*Myotis sodalis*) with aircraft as they migrate from their hibernacula to maternity sites (A. Hicks, New York Department of Natural Resources, personal communication; C. Butchkoski, Pennsylvania Game Commission, unpublished data; Fig. 18).

Radiotracking by aircraft is an attractive technique for investigating how known individuals of different species of nocturnal birds and bats use the landscape (e.g., Cochran and Wikelski 2005, Holland et al. 2006). Birds and bats have been followed with miniature tow of antennas is located where marks are seen and when a signal is determined by aircraft, by landmarks (e.g., antennae placed on edges, and

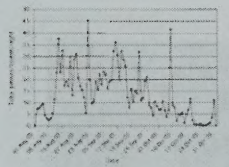


Figure 15. Sample calls from a preconstruction acoustic survey conducted at the Cumberland River Wind Project, Somerset County, Pennsylvania, USA (1 Aug–6 May 2004) showing wide number of bat passes per hours per night. These plotted data suggest a potential migratory pulse during October that merits further evaluation at a closer turbine height to assess potential migrating threats (modified, from Arnett et al. 2006).

species that can be identified. Acoustic detectors should be deployed on vertical arrays, with ≥2 levels (at 1.5–2 m above ground and as high as permitted by existing meteorological towers), preferably 3 levels, in all available towers. Sampling mid-sized masts with portable towers may be necessary to achieve sufficient spatial replication at a development site. Detailed guidelines for detector deployment and operation are reported elsewhere (Arnett et al. 2006, Reynolds 2006).

Postconstruction acoustic surveys can be used to support carcass surveys and provide information on changes in localized activity required during postconstruction surveys. These data would help verify estimates of risk at sites during preconstruction monitoring and could aid in assessing sources of mitigation measures. Postconstruction monitoring could also reveal unanticipated impacts from project related changes (e.g., clearing of a forested area). Increased detection of fatalities from carcass surveys may also provide justification to heighten the level of postconstruction acoustic monitoring as a means of evaluating causes and consequences.

By contrast, most acoustic surveys of bat activity report results as passes per detector hour or mean passes per detector night per season (Fig. 15). For consistency and comparison, detector hours should be normalized to hours past sunset for each date considered. This facilitates pooling and comparing data throughout a season or multiple seasons and years. In addition to assessing overall activity, data should be assessed by date and by detector to recognize temporal or spatial peaks in activity that may indicate particular threats to bats. Specific recommendations for how much activity poses a threat and responsive mitigation and avoidance guidelines remain an area of active research (Arnett et al. 2006).

Acoustic identification.—Acoustic identification of bat species poses a greater challenge than would be expected from experience with birds. Unambiguous species recog-

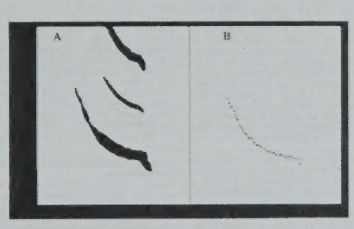


Figure 16. Echolocation call sonogram from a passive (real) Anabat monitor (Mammalian Ecology Laboratory) positioned 8 m (26 ft) above the ground on the summit of Anabat Hill, Bodega Canyon, near Bodega, California, 11 June 2007. The echolocation call sequence with the call in A appears to be a feeding buzz, and the call in B is a search call. The presence of harmonics (vertical striping lines) in call B indicates recording, some species such as silver-haired bats (*Lasionycteris noctivagans*), and big brown bats (*Eptesicus fuscus*) (J. Szewczak, Humboldt State University, unpublished data).

with aircraft but with high fatality exposure and limitations due to Federal Aviation Administration regulations and public safety. In some situations, it may be possible to track nocturnally active birds and bats from field-base Yagi antennae positioned on high places in the area under study (Larkin et al. 1996, R. P. Larkin, Illinois Natural History Survey, unpublished data). Such systems leveraged in a pulse line (string of animals) could be used to follow flight paths of several migrating bats (known individuals and species) across area such as mountain ridges. A model proposed to develop a global small animal satellite tracking system (Wikelski et al. 2005) holds considerable promise for investigating movements of small birds and bats over large temporal and spatial scales. The tentative framework for this project is outlined in the International Cooperation for Animal Research Using Space initiative. If satellite tracking of birds and bats with miniature transmitters becomes possible (Cochran and Wikelski 2005), this will open a new era of logistical feasibility for following nightly and seasonal movements of bats and birds.

METHODS AND METRICS FOR COLLECTING ADDITIONAL DATA ON NOCTURNALLY ACTIVE BIRDS AND BATS

Capture Methods

Captures of nocturnally active birds and bats may provide valuable information for assessing and confirming the presence of both resident and migrating species, but special training is presumed to respond to capture and release birds and bats from mist nets. Resident bird and bat species are easiest to capture when they forage near the ground, over bodies of water, or within and beneath the canopy of forests (e.g., Kunz 1973, Kunz 1982, Lloyd-Evans and Atwood 2000). Capturing migrating birds and bats during migratory movements can provide valuable demographic information (e.g., relative abundance, condition, age, and sex) needed for assessing population status provided that long-term, consistent efforts are made (Lloyd-Evans and Atwood 2004, Weller and Lee 2005, T. Lloyd-Evans, Manomet Center for Conservation Sciences, personal communication).

Because many bats fly above the height of ground-based mist nets, surveys should employ both ground level and elevated canopy nets, especially in forested landscapes and in riparian environments or over water holes (e.g., cattle tanks and ponds) located in agricultural and other open landscapes. Developing a capture history that can be used to estimate probabilities of detection and occupancy (e.g., program PRESENCE; MacKenzie et al. 2005, U.S. Geological Survey 2006) requires multiple visits. A single season, with only multiple visits, does not reliably sample but investigators or patterns of a single species (Weller and Lee 2007, E. B. Arnett, Oregon State University, unpublished data). Unless multiple capture efforts over multiple years are conducted, capture of bats should not be considered absent or to have lost relative abundance at a proposed site. Mist

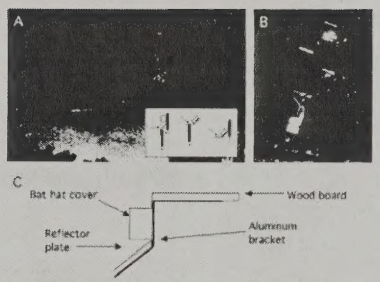


Figure 17. A) Another mistnetting protocol, by a wildlife group in Texas, in the daytime and baited to collect an assumed lizard-bat foraging guild. Where feasible, the mistnetting occurs downwind and outside tight-fitting chain-link fencing. Reflective tape around the perimeter of the fencing has been shown to reduce bat collisions with the fencing (Kunz and Parsons, unpubl. data). B) Bat hat mistnetting protocol, by a wildlife group in Texas, in the daytime and baited to collect an assumed lizard-bat foraging guild. Where feasible, the mistnetting occurs downwind and outside tight-fitting chain-link fencing. Reflective tape around the perimeter of the fencing has been shown to reduce bat collisions with the fencing (Kunz and Parsons, unpubl. data). C) Schematic diagram of bat hat used in mistnetting protocol shown in A. (A–B: S. Arnett, Bat Conservation International, used with permission)

netting used in conjunction with acoustic detection (Kunz and McAnulty 1998) may offer a more complete approach to evaluating presence of species at a site.

Devices and methods used to capture birds and bats have been thoroughly discussed elsewhere (see reviews in Kunz and Kurta 1988, Kunz et al. 1996, Brown 2005, Kunz et al. 2007*a*), so only a brief overview of methods is presented here. Although no single capture method is suitable for all species, most rules for birds and most nets and traps for bats can be the desired until more comfortable because they are relatively easily deployed and can be used in a variety of situations.

The choice of capture device for bats should be dictated by the subsets of animals present or expected at a particular site as opposed to strategy from a more limited view proposed for operational wind-energy facilities. In situations existing preconstruction surveys or proposed wind-energy facilities, where the local bat fauna and roost sites are unknown, ongoing efforts should focus on expected or potential monitoring, foraging, drinking, and roosting sites. Prior assessment of local topography, habitat structure (e.g., foliage density), and visual or acoustic surveys using ultrasonic detectors can often aid in the selection of potential capture sites and deployment of appropriate capture devices. Many of the methods used to capture birds and bats are similar—although some differences exist. For example, if bats are to be captured at roost sites to assess the species present in the vicinity of wind-energy facilities, or to monitor changes in cohort size, harp traps are preferable to mist nets (Kunz et al. 2006*a*). Most importantly, efforts should be made to minimize disturbance to bat colonies or colonial roosting birds.

Mist nets—A mist net consists of a nylon mesh supported by a variable number of taut, horizontal mounted lines, or shelf strings, that bats and birds are captured after they become entangled in the mesh of the nets. Mist nets are generally deployed where the horizontal shelf strings that support the net are rigid horizontally. The netting material should not be extended to its full extent, nor should slow-speed shelving between the shelf strings, to allow the formation of bags (or pockets) into which the bird or bats fall upon encountering the net. A bird or bat is captured in a mist net when it flies into the mesh between the shelf strings, and falls into a net bag from which it generally is unable to escape (Kunz 2003, Kunz et al. 2006*a*, *b*).

The type and number of nets, and the manner in which they are deployed, can greatly influence capture success. For most applications, ground-level nets are rarely to deploy, but they may bias the sample of captured birds or bats if some species fly (e.g., continue to forage) high or above the forest canopy. Use of canopy nets can provide access to the aerial space in forested regions where some bats and birds may forage or make flying migratory sequences (Fig. 19). Compared to ground-level nets, canopy nets may take longer to deploy, but they have the advantage of covering a larger area of vertical space above or beneath a forest canopy, including areas near the ground (Menzel and Menzel 1980, Hodgkison et al. 2002).

For detailed information on types and sizes of mist nets, preparation of nets for field use, deployment strategies in different environments, types of net poles, removing bats and birds from nets, and methods for dismantling nets, consult published descriptions (Kunz and Kurta 1988, Ralph et al. 1995, Kunz et al. 1996, Brown 2005, Kunz et al. 2007*b*).

Harp traps—Harp traps are recommended for assessing presence and relative abundance of bats in situations where opportunities for mist netting are ill advised or limited, especially where bats are present in relatively high densities at caves or caves, exhibits, or buildings near proposed or operational wind-energy facilities. Harp traps have proven successful for capturing bats as they emerge from roost sites during evening emergence and throughout the night as they periodically return and emerge during intermittent feeding bouts (Fig. 20). These traps consist of one or more rectangular frames, strung with a series of vertical wires or monofilament lines usually spaced about 2.5 cm apart. When a bat hits the back of wires or lines, it falls into a bag beneath the trap. In situations during potential situations emerge where the local bat fauna and possible colonies sites are unknown, harp-trapping efforts should focus on expected or potential commuting, foraging, drinking, and roosting sites.

Personnel assigned to capture bats at wind-energy projects may need certain state and federal permits to capture and handle birds and bats, especially endangered species. In the case of handling protected avian or mammal species and caves and wear proper gloves to avoid being bitten. Nets must be tended regularly to avoid injury to captured animals and to prevent damage to nets if too many bats are captured simultaneously. Normally active birds and bats captured at ground level, near water sites, or in the lower canopy, may not reflect the same composition of species that fly within the rotor-swept area or that are killed during migration.

Pre- and postconstruction surveys—Capture surveys for bats are frequently employed and often required by government agencies, particularly to assess presence of endangered species. However, not all proposed or operational wind-energy facilities offer conditions conducive to capturing bats and often the number of suitable sampling points is minimal. Inconclusive netting efforts occur at water sources set-outs or harp-trapping at nearby roosts, which may not reflect species presence at or use of the actual site where turbines are to be installed.

Mist netting alone may be inadequate for assessing bat activity at proposed or operational wind-energy facilities and, thus, should be considered a low priority in open landscapes such as grassland and agricultural fields (except where birds or bats are active over and near water tanks and reservoirs). Notwithstanding, mist netting and harp-trapping are the only available methods that can provide reliable information on sex, age, and reproductive condition, and when possible these techniques should be employed as part of pre- and postconstruction surveys. Captures of birds and bats near roost sites and in habitats known and adjacent to wind turbines can provide valuable information on population variables before and following construction of wind turbines, especially for the collection of tissue samples for DNA and stable isotopes, and for assessing demographic population size, genetic diversity, and geographic origins of bats and birds present during resident and migratory periods.

Estimating Population Size and Genetic Variation Using Molecular Markers

Estimates of population structure, genetic diversity, and demographic and effective population size are important parameters for assessing the dynamics of endangered, threatened, and species of special concern (DeYoung and Honeycutt 2005, Dalebout and Baker 2005, Kunz et al. 2005). Estimates of these parameters for both resident and migrating birds and bats are needed to better understand how populations respond to successful increasing mortality rates and anthropogenic factors such as climate change, deforestation, and habitat alteration. Wind-energy development, along with other anthropogenic activities, may have adverse effects on some bird and bat populations by directly causing fatalities and indirectly altering critical nesting, roosting, and foraging habitats. To adequately assess whether fatalities or altered habitats are of biological significance to resident and migratory birds and bats, knowledge of baseline population levels, population structure, and genetic structure are needed. These parameters can be specific to either among species that are subject to different risks from local and regional environmental factors.

Estimating demographic population size—Historically, estimates of population size of birds and bats have been derived using a variety of methods, including direct counts, point counts, and other estimating procedures such as capture-mark-recapture methods, photographic sampling, probability sampling, mark-mark likelihood models, and Bayesian methods (e.g., Bibby et al. 2000, Thompson 2004, Brown 2005, Kunz et al. 2006*b*). Notwithstanding, few statistically defensible estimates of population size for birds and bats have been published, especially for migratory (non-existing) bat species (O'Shea and Bogan 2003, O'Shea et al. 2003, 2004). Direct counts often are not practical for most nocturnally active bird or bat species, in part because these animals are typically small, cryptic, in otherwise difficult to visually census using most existing technologies during: 1) daily or nightly emergences from roosts, 2) migratory or foraging flights, or 3) migratory sequences.

Visual census methods of bat roosts—When bat colonies are relatively small (<1,000), visual censusing may be practical and potentially less disturbing to the colony than other methods (Kunz and Anthony 1996, Kunz 2003, Kunz et al. 2006*b*). Where large numbers of bats are present at roost sites, censusing previously using thermal infrared imaging cameras can provide reliable estimates of number of bats present (Sabol and Hudson 1995, Frank et al. 2003, Kunz 2003, Betke et al. 2007, 2008) although repeated sampling is required to assess seasonal changes in abundance and colony composition.

Genetic sampling—Noninvasive genetic sampling can provide valuable information for assessing population parameters of birds and bats at potential risk from wind-energy facilities and other anthropogenic influences. The DNA extracted from skin, hair, feathers, or feces may be used to identify individuals and species, estimate population size, determine sex, classify dietary items, and evaluate genetic diversity and population structure (Taberlet 2004, Waits and Paetkau 2005).

Identification of individuals should be the first step when assessing levels of genetic variation within populations. At least 30 individuals from a study population should be genotyped, with 10–25 microsatellite loci. Individual identification based on genetic samples can be used to obtain population estimates based on the minimum known size or estimates based on mark-recapture methods. Waits and Paetkau (2005) provide technical advice for accurate and efficient collection of genetic data for identification of species, sex, and individuals. Hair and wing tissue (for bats) and feathers and blood (for birds) are the most commonly used sources for noninvasive sampling.

Analysis of mitochondrial DNA (mtDNA) is used for species identification and nuclear DNA (nDNA) is used for individual and sex identification. The DNA extracted from fresher samples can be obtained from cells attached to the roots of feathers (Bonin et al. 2004). Hair bulges are the most common source of DNA for bats (Worthington Wilmer and Barratt 1996). In these situations, samples for DNA analysis can be collected from live or recently killed birds or bats. Extraction of host DNA from fecal samples is more challenging, and there is no consensus on the most appropriate method to use (Waits and Paetkau 2005).

Capture-mark-recapture models—Many basic tools to estimate population sizes derived from genetic samples (Waits 2004, DeYoung and Honeycutt 2005). Using this approach, Puechmaille and Petit (2007) compared estimates of colony sizes of the lesser horseshoe bat (*Rhinolophus hipposideros*) based on DNA extracted from feces with independent estimates of colony size derived from nightly emergence counts. Their results indicate that analysis of DNA can provide accurate estimates of colony size even when bats are collected during a single sampling session.

Estimating effective population size—Estimates of effective population size (N_e) also can be derived from genetic markers. Effective population size provides information on how fast genetic variation is being lost or substitutions is increasing in a population of interest (Lansing 2005). Knowledge of N_e is critical for assessing and managing threatened and endangered species or those of special concern because it provides information on how rapidly a population is losing genetic diversity. Thus, reductions in N_e also are related to reduced population viability. Comparisons of historic and contemporary N_e can be used to assess whether a population is declining (Luikart 2005) and, thus, suspects of anthropogenic-related factors (e.g., fatalities at wind energy facilities) or no genetic factors of population can be assessed (Landis and Barrowclough 1987).

Large populations typically accumulate more genetic differences and retain this diversity longer than do small populations (DeYoung and Honeycutt 2005). Because these effects are predictable, it is possible to estimate long-term effective population size based solely on observed patterns of DNA diversity. If a population changes in size, predictable effects on patterns of diversity occur, and these effects are proportional to that change. Thus, significant declines in population size through time can be documented, although there is often some lag between changes in population size and observable effects on genetic diversity. A conceptual description of the underlying process that results in these effects is provided below. More detailed descriptions and applications are found in Luikart et al. (1998), Ryman and Palsbøll (2001), Avise (2004), Russell et al. (2005), DeYoung and Honeycutt (2005), and references cited therein.

The genetic variation at any particular gene in a population can be illustrated as a topology or gene tree reflecting the historical relationships or genealogy of the gene copies found in different individuals. The number of mutations (i.e., nucleotide substitutions) separating these variable DNA sequences is a function of the demographic history of the population. Because mutations accumulate through time, sequences that diverged longest ago will be separated by a larger number of mutations than those that diverged more recently. If a historically large population remains large, its gene trees will have many branches of varying lengths that reflect the accumulation and retention of older and younger mutations. If a large population is reduced in size, its gene tree will be pruned. That is, genes reflecting both long and short branches will be lost with the result of less overall diversity. Short branches also will be proportionately fewer in the reduced population because fewer recent mutations occur and they are less likely to be retained because of the smaller population size. Consequently, if a population that was historically small expands in size, its gene tree will contain mostly of short branches as few of the increased occurrence and retention of recent mutations.

It is important to understand the extent of population-level monitoring because it can affect molecular among species (DeYoung and Honeycutt 2005). For example, population genetic studies on the Brazilian free-tailed bat (*Tadarida brasiliensis*) show high levels of genetic diversity and little population-level structuring (Russell and McCracken 2006), whereas other species, such as the Townsend's long-eared bat (*Corynorhinus townsendii*) show relatively low levels of genetic diversity and high population structuring.

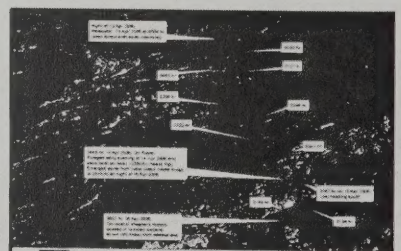


Figure 18. Topographic overlay of Buffalo Ridge Phase I (foreground) and Phase II (background) wind-energy projects in southwestern Minnesota, USA. The bat and approximate boundaries are shown in white (modified from Johnson et al. 2003). The bat was tracked by ground tracking as it subsequently flew to the northeast (Kunz et al. 2007*a*). Inset: Location of the Buffalo Ridge wind-energy projects in Minnesota. In the early morning of 14 August a migrating female bat was captured in a mist net at 2030 hours (this is local time) at the Lower Buffalo Ridge I project (Kunz et al. 2007*a*). The bat was fitted with a radio transmitter and released at 2130 hours. Radio-tracking data indicate that the bat flew in a northeasterly direction for 56 km before it was relocated at 0130 hours. The bat remained within the area for about one hour. (C. M. Boyd/Kunz and C. Corben/Photographic Rates and Bats Conservation, unpublished data)

The implications of these and other studies using molecular markers (Avise 1992, 2004) indicate that different species are subject to different risks from anthropogenic influences and should be studied to assess whether a given species is more at risk from changing environmental factors, relative effective population size, and genetic diversity are considered. Changes in sex ratios in populations can cause changes in effective population size, and when effective population size decreases, populations tend to lose genetic diversity. Loss of genetic diversity can lead to loss of fitness (DeYoung and Honeycutt 2005).

Estimates of effective population size based on genetic diversity have been applied to a variety of birds and mammals to investigate patterns of change caused by human interactions (DeYoung and Honeycutt 2005). For example, the historical population sizes of Seychelles kestrels (*Falco araeus*) and fin whales (*Balaenoptera physalus*) prior to hunting by humans were estimated to consist of approximately 340,000 and 360,000 whales, respectively, contrasted to modern population sizes of 10,000 and 56,000 individuals, respectively (Korsan and Palsbøll 2005). The historical estimate of the effective population size of the gray wolf (*Canis lupus*) prior to human settlement of North America was estimated at approximately 1,000,000, as compared to the current estimate of 175,000 (Vilà et al. 2003). For bats, molecular analyses techniques are experimental migratory population of Brazilian free-tailed bats approximately 1,000 years ago, a time that corresponds with the development of a warm climate and increasing insect availability (Russell et al. 2005, Russell and McCracken 2006). This was apparently followed by an approximately 10-fold decline in estimated populations size in more recent times, postulated as a consequence of human activity (Russell et al. 2005, Russell and McCracken 2006).

For the lesser long-nosed bat, the most recent estimate of effective population size was 149,000 individuals (Wilkinson and Fleming 1996). These and other estimates of effective population size reflect the current distributional ranges of a given species. However, census data on populations size are needed when evaluating cumulative impacts resulting from anthropogenic changes. For example, current estimates of colony sizes for Brazilian free-tailed bat

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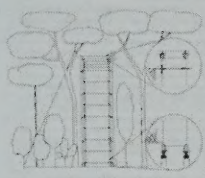


Figure 89. Multiple mistnet harrowed nets are used for sampling nocturnal birds from ground level over the forest edge canopy (from Hutchinson et al. 2003).

Figure 90. Many traps can be used to successfully capture bats as they emerge from a roosting structure such as buildings, caves, and hollow trees (photograph © Christine Drennan Southworth, Bat Conservation and Management, Incorporated, used).

based on thermal infrared imaging and computer vision technologies, emphasize the importance of establishing baseline levels and for conducting long-term studies for assessing cost and proportional impacts on local and regional populations (Beston et al. 2006, N. J. Hobson and T. H. Kunz, Boston University, unpublished data).

Migratory tree-roosting bats are especially challenging organisms to assess, largely because bats are solitary and occur in foliage, crevices, and bats and bears hard to see cavities (often treated bats, Carter and Menzel 2007). Instead of using traditional mobility methods, molecular markers could be used to estimate population sizes after identifying individuals from the DNA obtained noninvasively from samples of hairs, feces, or skin tissue. As with traditional methods, the reliability of population estimates based on molecular methods relies on the assumptions (DeYoung and Honeycutt 2005). For example, population size can be under- or overestimated if sampling errors are made when the alleles of heterozygous individuals are not amplified during a genetic polymerase chain reaction (PCR), or PCR-generated alleles create a slippage artifact during the first cycle of the reaction (Wang and Lelong 2000). Errors of this type can be minimized by repeating the process of genotyping and comparing genotypes to each other (Pompanon 2005).

There are several potential limitations in using genetic sampling to estimate population parameters from both nuclear DNA and mtDNA markers, including contamination of field samples, identifying enough loci to establish adequate resolution sufficient to distinguish individuals, and genotyping errors. If sufficient data are not collected for an adequate number of loci, then the number of individuals in the population will be underestimated. Removing the number of loci, with sequential exclusion, also increases the probability of observing genotyping errors.

which can lead to significant statistical and deductive inferences. Ultimately, when assessing risks to potentially active bats or bats at a proposed wind-energy site, in order to design an appropriate sampling protocol and account for the aforementioned factors may increase the likelihood of a Type II error (i.e., failing to reject a false null hypothesis and concluding no effect when, in fact, there is one).

A fundamental gap in our current knowledge of preconstruction assessment of risk is that no linkages exist between presettlement risk estimates and potential fatalities for nocturnal wildlife. Although intensive studies are underway (Arnett et al. 2008), it may be several years before methods described in this document can be used to predict fatalities with an acceptable level of precision, accuracy, and degree of confidence.

In the case of Federally endangered species, the course of action for decision-making is reasonably well-defined. For example, a developer who finds Indiana myotis (*Myotis sodalis*) during summer surveys on a project area may enter into voluntary negotiations with the United States Fish and Wildlife Service (USFWS) to receive an incidental take permit under the auspices of a Habitat Conservation Plan under Section 10 (a) (1)(B) of the Endangered Species Act to may chose to abandon the project due to high risk of injuring additional endangered species (U.S. Fish and Wildlife Service 2003).

Currently, there is neither a framework nor empirically driven guidelines for agencies or developers to know what 14.7 (±1.1 SD) bat calls per night garnered with acoustic detectors or a passage rate of 116.7 (±9.6) targets/km/hour collected from radar actually mean compared to 23.1 (±6.3) bat calls per night or 39.5 (±7.1) targets/km/hour, except that the activity and resource is about 3 times higher in turn years. Thus, establishing linkages between preconstruction metrics and postconstruction fatality estimates is a vital next step toward being able to predict impacts and, thus, provide the context needed for decision-making. Until additional empirical data are gathered and a relationship between independent variables and the number of fatalities, establishing decision-making criteria will be far more challenging, contentious, and potentially charged than improving the sampling designs and quality of information gathered. Considerable uncertainty and risk, inside or existing decision making frameworks, but to best assess the inherent uncertainty gathered during the preconstruction period, risk frameworks are needed for stakeholders to agree upon and implement. Established quantitative criteria for decision-making should be based on the best available scientific information and subject to change as new information is gathered, following the fundamental principles of adaptive management (Holling 1978, Walters 1986).

Postconstruction Studies

Many of the methods and metrics described for preconstruction surveys must be used effectively during the postconstruction period, including visual, acoustic, radar, and capture methods. In addition, postconstruction studies require estimates of actual bird and bat fatalities.

Estimating fatalities and activity.—With few exceptions, postconstruction monitoring has centered on facility searches. Past postconstruction studies have employed observer detection to record bat activity at operating wind facilities (Kerns 2002, Johnson et al. 2003, Erickson 2004, Jain 2005, Arnett et al. 2006). However, only one study in North America has used thermal imaging cameras to observe bat behavior and interactions with turbines (Horn et al. 2008). Efforts to develop multiple tools (e.g., acoustic detection, radar, and thermal imaging cameras) at proposed wind facilities, or those currently operating, are underway in an attempt to test various methods for evaluating postconstruction activity of birds and bats and establishing relationships between flight activity and fatalities (D. Reichel, Wisconsin Department of Natural Resources, unpublished data; W. M. P. Barclay and E. Baerwald, University of Calgary, personal communication; A. Kelts, personal communication).

Postconstruction studies using multiple tools (e.g., acoustic detectors, radar, night-vision devices, and thermal infrared cameras) are needed to determine the context and relative exposure of nocturnal animals using the airspace in relation to observed fatalities. Numerous reports and experimental impact assessments argue that fatalities of bats at wind-energy facilities are lower in the western United States and within agricultural regions, for example, compared to forested ridge tops in the eastern United States. However, fatalities could be proportionally the same in relation to regional populations or simply the numbers of animals using the airspace in the two localities occur. Until this context is established, we suggest that comparisons and extrapolations among regions, especially when carrying methods are employed, be viewed cautiously.

Fatality assessment.—Experimental designs and methods for conducting postconstruction fatality searches are well established (Anderson et al. 1999, Morrison et al. 2003). Although the statistical properties for most of these common estimators have been evaluated and suggested to be unbiased or close to unbiased under the assumptions of the simulations (W. P. Erickson, WEST, Inc., unpublished data), important sources of field-sampling bias should be assessed for to correct estimates of fatalities. Important sources of bias include 1) fatalities that occur on a highly periodic basis, 2) carcass removal by scavengers, 3) searcher efficiency, 4) failure to account for the influence of site conditions (e.g., vegetation) on carcass retention and searcher efficiency (Osborn and Anderson 1992, Peterson et al. 1993, Anderson et al. 1999, Morrison 2002), and 5) fatalities or injured bats that may land or move outside exact plots.

Temporal distribution of fatalities.—Most researchers assume that fatalities are uniformly distributed, and at independent locations exists between search days. However, if the distribution of fatalities is highly clumped, then estimates may be biased, especially if carcass removal rates are high. Most researchers apply an average carcass rate of carcass removal expected during the study. If most fatalities

the geographic origin of migratory animals is comparing tissues collected at different seasons and to different parts of their range (Chamberlain et al. 1997, Hobson and Wassenaar 2001, Meehan et al. 2001, Cryan and Diehl 2008).

Kelly et al. (2002) used stable isotopes of hydrogen extracted from the feathers of breeding, migrating, and wintering Wilson's warblers (*Wilsonia pusilla*), and found that δD values were positively and significantly correlated with latitude of collections, indicating that δD values in feathers provided a good description of the breeding latitude. Cryan et al. (2004) also used stable isotopes of hydrogen to infer migratory movements of hoary bats in North America. Using data collected from feather samples, several studies have used both stable isotope and genetic markers to evaluate migratory habits of birds (Clegg et al. 2003, Kyle and Robertson 2004, Hobson 2005, Kelly et al. 2005, Smith et al. 2007).

The primary limitations of using stable isotopes for assessing migration of birds and bats is that the stable isotope of hydrogen can vary locally, based on differences in precipitation and ground water. Thus, when tissues are collected from birds or bats, samples of precipitation and ground water should be collected at the same time to improve the geographic resolution of isotopic maps (L. I. Wassenaar and K. A. Hobson, Environment Canada, unpublished communication). Currently, the resolution of isotopic ratios of hydrogen in precipitation in relatively stable with respect to latitude, longitude, and altitude, and it may not be possible to precisely identify source areas of breeding birds or bats within a small geographic region (Chamela et al. 1998) appropriately accounted for the importance of avoiding environments where using stable isotopes and caution for laboratory experiments to validate methods.

Collecting tissue samples for DNA and stable isotope analysis.—Using or dead bats collected at or in the vicinity of wind energy facilities can provide invaluable data for advancing knowledge about the geographic sources and abundance of resident and migratory populations. Tissue (or wing biopsies) collected from bats (Worthington Wilmer and Barratt 1996) and blood or feathers from birds (Smith et al. 2003, Watts and Paxton 2007) can be used for analysis of genetic structures, population structure, for potentially assessing population size using DNA markers, and for assessing the geographic origin of migrants based on stable isotope and genetic analysis. Data, such as species, sex, age, reproductive condition, and standard external measurements for each bat, dead, or anesthetized bird and bat captured or encounter should be recorded.

Use of mtDNA and cDNA consensus data derived from birds and bats killed by wind turbines may offer the potential for identifying closely related or cryptic species. For example, many species of *Myotis* are difficult to identify from either external morphological characters or echolocation calls, or they can be identified using unique DNA markers (e.g., Ruedas et al. 2004, Stadelbacher et al. 2007).

Developing *calibrations*.—Calibrations with researchers experienced in genetics and stable isotope analyses are highly recommended. Carcasses should be collected as part of bird mortality and dependent on searches opportunities in research laboratories associated with universities and natural history museums. In the United States, the American Museum of Natural History, New York, serves as a repository for tissues collected from dead or living bats recovered from research wind turbines are collected (http://research.amnh.org/vz/mammalogy/tissue_archive), curator N. B. Simmons, American Museum of Natural History. The Cooperative Colorado Research Center, Center for Tropical Research, University of California, Los Angeles serves as a repository for feather samples from which stable isotope and genetic analysis of birds can be conducted (http://coloradocafe.edu/CTR/page.html, contact J. Pellegrin, University of California, Los Angeles).

CONDUCTING PRE- AND POSTCONSTRUCTION MONITORING

Many of the methods and metrics summarized above for monitoring nocturnally active birds and bats have been applied during pre- and postconstruction monitoring and research efforts. In this section, we describe basic approaches and protocols to guide pre- and postconstruction monitoring and research, discuss factors influencing and limiting protocol development and implementation, and offer considerations for future monitoring and research.

Preconstruction Studies

Preconstruction assessments at proposed wind energy facilities generally are initiated from early permits evaluations in consultations with state or Federal agencies with respect to wildlife, including potential direct impacts to bird and bat species, especially endemic migrants, and threatened and endangered species or species of special concern. Agencies generally request that data be used to characterize wildlife resources in the context of a proposed development, to evaluate site potential, impacts from such development, and to the greatest extent possible, determine the location of turbines that will minimize risk to birds and bats. Although these objectives may provide useful information for developing a facility and siting specific turbines, or perhaps siting in the decision to abandon a project altogether, each project may require a different sampling design, level of sampling intensity, and volume of data to be collected.

Multiple factors may influence preconstruction monitoring and confidence of the data collected as outlined in the original "Methods and Metrics" document (Anderson et al. 1999), as well as other works (e.g., Shields 1994, MacKenzie et al. 2005, Morrison et al. 2006, Pollock 1991, Pollock et al. 2002). Designing a preconstruction study protocol should begin with clearly defined questions. Then, a clear understanding of the relevant questions should dictate the sampling design and methods. An inappropriate protocol may result in low power to detect differences (Strelli et al. 1997), failure to account for spatial and temporal variation (Hoera 1997), and pseudoreplication (Hurlbert 2004), all of

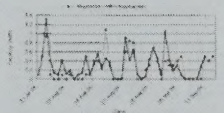


Figure 28. Comparisons of daily fatalities (no. of bats) for fatalities (no. of carcasses corrected for bias) for (during) (no. carcasses) and bats (carcasses) found by Mountaineer Wind Energy Center, Tucker County, West Virginia, USA (31 July–30 Sept 2004) and the Meyersdale Wind Energy Center, Somerset County, Pennsylvania, USA (2 Aug–15 Sep 2004). Fatality rates in the estimation of bat loss based on a given for fatalities for the number of carcasses searched that the fatality is at 45%.

would immediately after a search, they would have a longer time to be measured before the next search, resulting in higher scavenging rates than the average rate used in the calculations. This would lead to an underestimate of fatalities. On the other hand, if most fatalities occur before our first visit to the next search, the fatalities may be overestimated. Potential biases are minimized by ensuring that some searches are conducted most carriages during the survey period, and that they are well-distributed throughout the area of interest (Fig. 21).

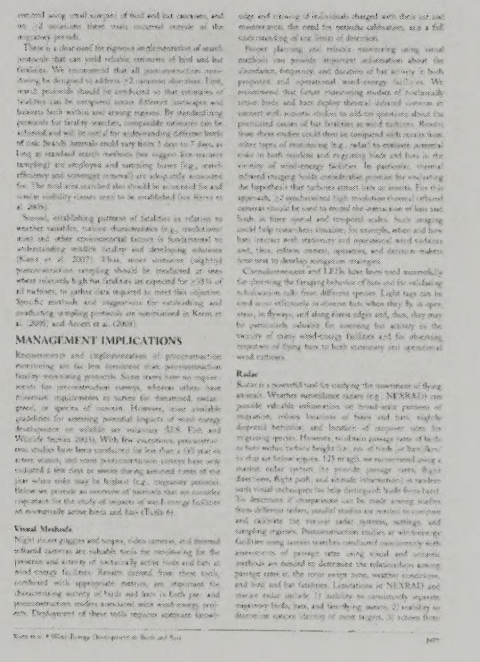
Scavenging tests.—The second source of bias in fatality estimation relates to assessing carcass removal rates by scavengers. All wind energy facilities will be inhabited by a variety of potential avian (e.g., corvids [Corvidae], raptors [Accipitridae], mammalian [e.g., skunks [Mephitidae], raccoons [*Procyon lotor*], and coyotes [*Canis latrans*]), and insect (e.g., burying beetles and ants) scavengers, and searchers, especially those conducted at low-frequency intervals, may result in highly biased estimates of fatality (Morrison 2002). Past experiments that have assessed carcass removal using small birds as surrogates for bats may not be representative of scavenging for bat carcasses. Two studies conducted by Erickson et al. (2002) and Johnson et al. (2003) used bat carcasses (presumed to be killed the previous night when frozen and found similar results scavenging rates or bat carcasses compared to small bird carcasses. However, small sample sizes may have biased estimates and limited the scope of inference of these 2 studies. Stoffer (2004) and Fiedler et al. (2007) conducted 4 bias trials during the first phase of development at the Buffalo Mountain Energy Center in Tennessee and found no difference between bird and bat carcasses for searcher efficiency or scavenging rates. Nonetheless, Kunz et al. (2007), however, reported significantly lower scavenging rates on birds compared to both birds and frozen bat carcasses at the Mountaineer Wind Energy Center in West Virginia. Scavenging should be expected to vary temporally (e.g., seasonally and spatially from site to site and among both successive habitats (e.g., forests vs. grasslands or agricultural landscapes) and extensively vegetation conditions at any given habitat (e.g., bare ground compared to short grass or agricultural stubble).

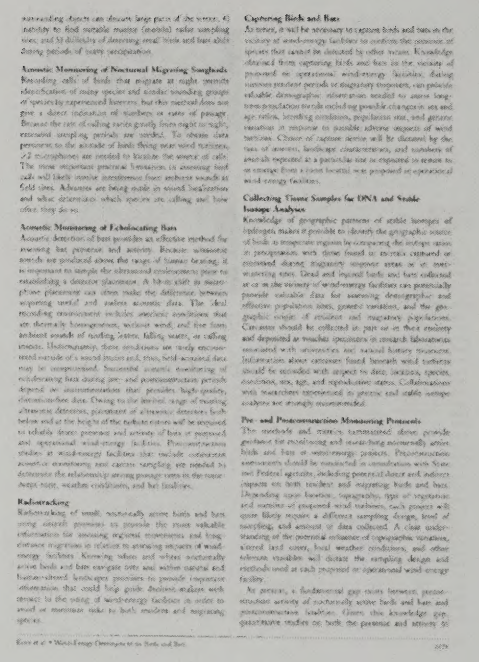
Searcher efficiency.—It is well known that searcher efficiency or observer detection (i.e., the rates at which searchers detect carcasses) varies among individuals (Mastrangelo et al. 2003). Searcher efficiency also can be biased by other factors including topography, vegetation, condition of carcasses (e.g., decomposed remains compared to fresh), intact carcasses), weather, and lighting conditions. Searcher efficiency and carcass scavenging should be assessed to any considerably within and among different vegetation cover conditions (Wolfson and Wolfson 1992, Hallinan et al. 1995, Anderson et al. 1999, Morrison 2002, Arnett et al. 2008). The use of trained dogs can increase the efficiency rate of carcasses, especially in heavy vegetation cover, and offers promise for addressing many questions surrounding bat fatality at wind facilities (Arnett 2006), although dogs undoubtedly vary in their ability to detect carcasses.

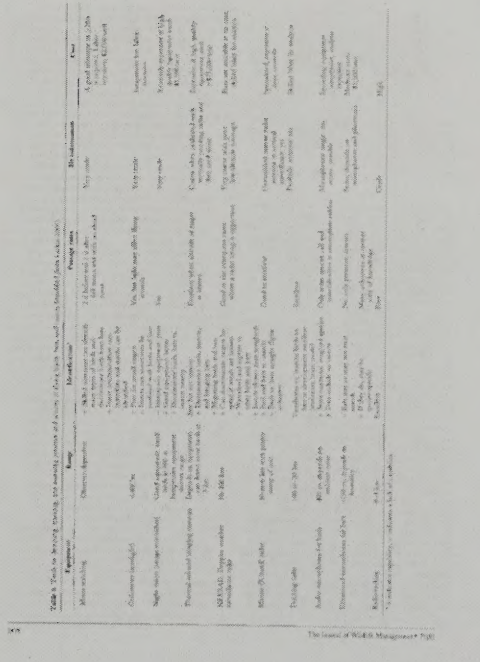
Size of search plots.—Size of plots have varied among studies. Many recent studies used rectangular search plots with radius of plots a maximum distance from the turbine equal to the maximum tip height of the turbine. Observed spatial distributions of fatalities suggest that most, but not all, fatalities occur in the general area. However, topography, structure of vegetation, size of carcass, wind direction, and other factors likely affect the distribution. This distribution can be used to approximate the number of fatalities missed (Arnett et al. 2005, Arnett et al. 2008, W. P. Erickson, personal communication). More studies have shown a tighter distribution of bat fatalities around the turbine compared to bird (Kerns et al. 2005). Additional factors affecting the precision and accuracy of fatality estimates include search effort, including the number of turbines searched, intensity of searches within search plots, and the experience of observers (Anderson et al. 1999).

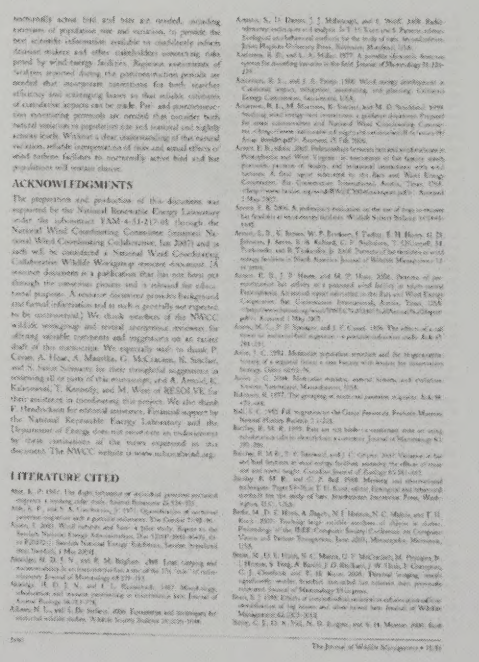
Search intervals.—Fatality search intervals have varied considerably among studies. Sampling methods and duration for 21 postconstruction studies conducted in North America are summarized by Arnett et al. (2008). Fatality searches usually are conducted on a systematic schedule of days (e.g., every 1, 2, 3, 4, 7, 9, or 14 d) but rarely have daily searches been employed (Kerns et al. 2005). More intensive searches often are performed during the spring and autumn migratory periods, whereas summer breeding periods (some turbines are not frequent or not conducted at all. By contrast, when they are conducted, most spring and autumn postconstruction carcass searches at communication towers are performed nightly (Manville 2005).

Although there are multiple approaches to performing searches (e.g., line transects, mobile plots), any protocol that is used must thoroughly examine the aforementioned sampling issues to obtain reliable estimates. Most fatality studies to date have poorly accounted for searcher efficiency and removal by scavengers, removals for bats (NRC 2007, Arnett et al. 2008). Some studies adjusted fatality estimates based on a single trial for searcher efficiency and scavenger









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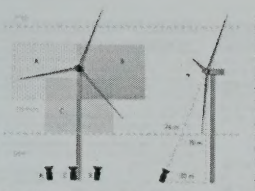


Figure 1. Field configuration for conducting nightly observations of bats, birds and insects with thermal infrared cameras at the Mountaineer Wind Energy Center in West Virginia, USA, August 2004. The facility includes 44 turbines that are positioned along a ridge-top and on a forested mountain ridge. Cameras were positioned together 30 m from the turbine base and proximal directly upwind and perpendicular to the plane of blade rotation. Observed bats, birds and insects were classified into high, low, and medium height categories corresponding to flight elevation relative to the height of the area swept by the turbine blades.

Our system captured data at a rate of 30 frames per second and stamped each frame of data with the time accurate to 0.001 seconds.

To facilitate observations of nightly flight behavior of bats, we placed the observation station near the base of wind turbines at dusk. Terrain permitting, we positioned them as close to 80 m as possible from the base of each turbine tower (Fig. 1). In general, we positioned camera stations directly upwind and perpendicular to the plane of rotation, based on typical turbine orientation. In most cases, the station was at an equal elevation at the base of the tower, so that the straight-line distance from the camera to the hub was 76 m. We positioned and focused each camera on a different part of the rotor-swept area: camera A on the left, upswing portion of the rotor-swept area, camera B on the right, downswing side, and camera C on the lower portion of the rotor-swept area.

We recorded 3 9-hour video sequences (one for each camera angle) nightly for 10 nights. We recorded images continuously beginning at 2030 hours and continuing until 0530 hours the following morning. We started the 3 cameras simultaneously (<1 second from each other and, thus, synchronized our recordings. To test the potential of aviation lighting on the turbines to attract bats, we placed the cameras alternatively at randomly selected lighted and unlighted turbines for 5 nights each.

We analyzed our data by manually observing playback of all video sequences in real time or 2× real time, recording the appearance and timing of flying objects. We recorded each object observed with a time stamp and categorized it according to a set of qualitative criteria as a bat, insect, bird, aircraft, or unknown (unidentifiable) object. Criteria included object size, object morphology, estimations of inertia and velocity, evaluation of flight maneuvers and behavior, wing-beat frequency, and interaction with the rotating turbine blades. In an effort to reduce false positives and observer biases, we were highly conservative when classifying objects, categorizing many as unknown. We made every effort to make accurate identifications, and to reduce false positives, including counting multiple passes that belonged to a single individual as a single appearance. We also assigned a behavior type to each object observation. Objects flying through the field of view without incident were labeled as fly. Those making sharp or sudden course corrections synchronous with a nearby moving turbine blade we labeled avoid. To distinguish these behaviors from normal foraging and pursuit maneuvers, we were careful to label behaviors as avoid only when they occurred at the same time that a turbine blade was moving through nearby airspace. Any obvious collisions or contact with any part of the turbine structure we labeled contact. Each observation record also included an estimation of flight elevation, based on the rotor-swept zone of the turbine structure. We classified elevation as low, medium, or high. Low corresponded to flying objects below the rotor-swept zone, medium to those in the range of heights of the swept zone, and high to those above the swept zone. We also noted the entry and exit points from the field of view as an estimate of flight heading of an object.

We compiled observation records into a database along with 10-minute observations of wind speed, wind heading, temperature, and blade rotation speed that were generated from the instrumentation on each turbine nacelle (the structure at the top of the nacelle to which the rotor hub and blades are attached that contains the electrical generator, gearbox, and electronic controls). We also compiled data on wind speed, wind heading, and barometric pressure from 2 installed meteorological towers (met towers) that were located at 2 midpoints along the string of turbines. We analyzed and processed data from this database, and we performed all statistical tests using the statistical software R (The R Foundation for Statistical Computing, http://www.r-project.org/). The Boston University Animal Care and Use Committee approved protocols used in this study.

RESULTS

We recorded 30 continuous nightly video sequences, of which we analyzed 19, representing 171 hours of video and observation time. We divided the observations into 2 categories: a subset of nights for which we analyzed data from all 3 cameras (A, B and C; $n = 4$), and nights for which we analyzed data from camera A only ($n = 10$; left upswing portion of the rotor-swept area; Fig. 1). For all cameras combined, we observed 4,568 moving objects: 1,810 bats (39%), 572 insects (13%), 46 birds (1.0%), 5 aircraft (0.1%), and 1,835 unknown (40%). For the A camera dataset, we recorded a total of 2,404 observations: 998 bats (41%), 503 insects (20%), 39 birds (1%), 2 aircraft (0.1%), and 862 unknown (35%; Table 1). We observed bats at a mean rate of 9.9 per turbine per night, and 1.1 per turbine per hour. We compared the number of bats observed with each of the cameras, left (A), right (B), and lower (C), during 5 nights of observations (Table 2). In general, we observed more bats from camera C ($n = 548$) than from A or B ($n = 389$, and 244 respectively). This may be due to the slightly lower elevation angle of camera C, allowing it to capture objects that were closer to the lens and, therefore, more easily identified as bats. However, total numbers of bats observed were variable from camera A to camera B and we found no significant difference between mean numbers of bats observed from any single camera ($t = -1$; A vs. B, $t = 0.56$, $P = 0.60$; A vs. C, $t = -0.61$, $P = 0.57$; B vs. C, $t = -1.46$, $P = 0.261$. We, therefore, treated observations from camera A as proportionately representative of bat activity during any given recording session, and decided to focus the analyses on a single camera and a larger sampling of nights and turbine locations.

Bats were usually distinguishable from other near-field objects (birds and insects) based on the orientation of the body and wings, which aided in their identification. We observed pursuit and terminal-phase capture maneuvers (Griffin 1990), with individuals turning and persisting in the field of view for durations of 5–120 seconds. We classified 40% of all observations as unknown, reflecting both our effort to avoid inaccurate identifications, and the difficulty of discriminating bats from birds and insects in foggy or cloudy conditions.

Among flying bats, altitude above ground level (AGL) was highly variable, with some individuals flying within 10 m AGL, and others flinging at or above the height of the turbine nacelle (70 m AGL). We observed few birds, mostly individuals, but also occasional flock formations. Insects were abundant within the low-altitude band (below the rotor-swept zone), and they often appeared as cooler and less well-defined objects because they were outside of the camera's depth of field (Fig. 2). Insects were not generally visible in the medium to high elevation ranges owing to their small size and lower body temperature. The vast majority of bats we observed were flying at the medium-altitude band (within the rotor-swept zone; 65.9 bats/night—>3 times the number observed flying at low or high altitudes (22.7 and 11.2 bats/night, respectively). Although camera resolution and cloud cover may bias our estimates of high flying bats downward, the number of medium flying bats still greatly outnumbered low-flying bats by a factor of 6:1. Bats appeared to spend much of their time foraging and flying at the range of altitudes at which the turbine blades were operating (24–113 m AGL).

To determine if objects identified as bats were within the altitude range of the rotor-swept zone, we analyzed 5 single instances of avoidance behavior, wherein bats appeared to be buffeted by passing blades, or changed course abruptly to avoid contact with blades. Given the field of view of the lens (24°), the detector array size (320 × 240 pixels), and the average length (11 cm) of the species found in the companion study (Kerns et al. 2005), we calculated that a single illuminated pixel in the video image corresponds to a single bat at 92.5 m from the camera. Therefore, given the mean number of pixels per bat in these images, the mean distance of the bats from the camera in the 5 avoidance sequences was 29.98 ± 2.56 m (SD). This distance corresponds to the distance to the boundary of the low- and medium-altitude bands. Although this measure adds confidence to the identification of bats in the video sequences, it should be noted that many factors can influence the number of pixels representing a bat in an image, including fog, camera focus, the integration time of the sensor array (image blurring), and the orientation of wings to the camera lens.

The number of bats we observed on a nightly basis was highly variable, with as few as 9 per night, and as many as 292 ± 92 (SD; Fig. 3). In fact, there was a significant difference in the mean number of bat passes observed on a nightly basis ($t = 10$, $t = 3.37$, $P = 0.008$). Insect activity also was highly variable, but proportional to bat activity ($R^2 = 0.51$, $P = 0.012$). There was a significant correlation between insect passes and bat passes observed across all nights ($t = 0.71$, $F = 4.03$, $P = 0.039$). A regression analysis indicates that insect activity was a significant positive predictor of bat passes ($R^2 = 0.51$, $F = 8.14$, $P = 0.02$; Fig. 4).

Analysis of temporal distribution of bat activity throughout the night revealed that activity was conspicuously higher in the first 2 hours after sunset, and then tapered off with a lull in activity near midnight (Fig. 5). We observed higher numbers of bat passes after the midnight lull in some datasets, but the overall trend can be characterized by a gradual decrease throughout the night. Flying insects appeared to be most active in the hours immediately after sunset, with their numbers declining steadily throughout the night (Fig. 5).

Aviation lighting did not appear to affect the incidence of foraging bats around turbines. Although we observed more nightly bat passes at lighted turbines ($n = 562$, $\bar{x} = 112$, $\pm$ SD = 108) than at unlighted ($n = 435$, $\bar{x} = 87 \pm$ SD = 96.2), there was no difference between these groups ($t = 0.42$, $P = 0.68$). Interestingly, the mean number of insect passes was slightly higher at lighted turbines than at unlighted turbines, but the difference was not significant at the 0.05 level ($t = 1.62$, $P = 0.14$). This suggests that aviation lights may attract insects, but that the increased insect abundance may not result in increased bat activity. However, this test has low statistical power because of the small sample size ($n = 10$, power = 0.53).

We evaluated the effects of nightly wind speed at the turbine, mean wind speed for all turbines, mean wind speed at the meteorological towers, temperature at the turbine, mean temperature for all turbines, turbine rotation speed (measured in RPM), mean turbine RPM, turbine heading, mean turbine heading, and insect abundance on bat activity in separate regression analyses. Of these variables, we found that mean turbine RPM and insect abundance were the most significant predictors of number of bat passes observed (Fig. 4). Ambient temperature and pressure did not significantly predict bat passes. A multivariate regression analysis of wind speed, temperature, and turbine RPM shows that together these variables predict the number of bat passed observed ($R^2 = 0.95$, $F = 14.4$, $P = 0.012$).

Turbine RPM ($t = 6.44$, $P = 0.02$) and insect abundance ($t = 7.21$, $P = 0.01$) were both positive predictors of bat passes.

Although most bats were observed foraging on flying around turbines, we also recorded clear instances of avoidance of blades and bats being struck by turbine blades. From 998 total bat observations, we observed avoidance behavior 43 times (4.1%), 4.1 instances of avoidance/contact/night). In this analysis, we excluded, to the extent possible, observations involving multiple appearances of the same bat. Avoidance involved sharp, evasive flight maneuvers that were coincident with a moving blade. Notably, many of the instances of avoidance behavior involved multiple passes. Bats often appeared to investigate the turbine blades after a near miss, rather than fly off quickly. This often resulted in several additional near misses in a row, with the bat appearing to be repeatedly buffeted by turbulence close to the blade surface. We estimate that such interactions occurred within 5 m of the blade surface. Thermal infrared video segments of this and other bat flight behaviors near turbines recorded during this study can be viewed at http://www.bu.edu/csp/research/videos.

We observed direct contact with moving blades 9 times out of a total 998 passes (0.8%; 0.5 instances of contact/turbine/night). Extrapolating to the size of the entire facility (42 turbines), bats may be struck at a rate of 21 bats per night at the Mountaineer Facility. Contact was only observed with moving blades. In no cases did we observe a bat striking the turbine monopole, nacelle, or stationary blades. Collisions were marked by an abrupt, angular change in heading and velocity (Fig. 6) and were generally of 2 types: glancing blows and direct hits. One collision was a glancing blow and the bat experienced a sudden deceleration and change of heading but appeared to recover and continue normal flight. We also witnessed 4 direct hits in which bats appeared to be struck closer to the centerline of a moving blade, and were greatly accelerated. We were unable to confirm that bats struck by the blades landed beneath the turbine, as the field of view of the cameras did not include the ground. The 4 collisions we observed occurred when the

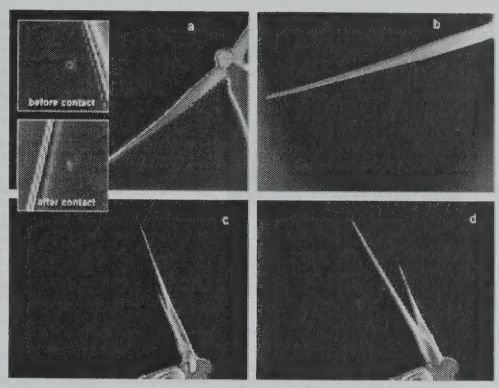


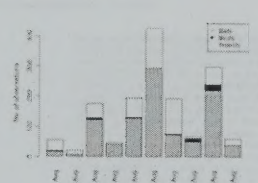
Figure 2. Single frames of thermal infrared camera images illustrating interaction observations at the Mountaineer Wind Energy Center in West Virginia, USA, in August 2004. (a) The movements recorded before and after contact with a turbine blade. (b–d) Low-medium flying bats at one time in the camera field of view (b), a typical high fast flying above the height of the turbine blades (c), and a typical low-flying insect, characterized by the less contrast (cool) blurry streak, an artifact caused by the camera's integration time, indicating that motion is low in the scene. Thermal infrared video segments of this and other bat flight behaviors near turbines recorded during this study can be viewed at http://www.bu.edu/csp/research/videos.

Table 1. Observations from camera A (left half of the rotor-swept area) that were recorded at the Mountaineer Wind Energy Center in West Virginia, USA, in 2004. "Avoid" indicates observations in which either the wind flight path to avoid collision with a moving blade, and "contact" indicates a blade striking a bat.

		Observations of bats, birds, and insects at wind turbines						
Date	Turbine no.	Total	Bats	Birds	Insects	Unknown	Bat avoid	Bat contact
8 Aug	18	72	37	2	15	19	2	0
10 Aug	27	27	9	0	12	6	0	0
11 Aug	25	251	124	5	47	75	4	0
13 Aug	26	92	47	0	5	40	3	0
14 Aug	37	362	129	2	62	168	3	0
16 Aug	41	298	202	1	139	362	10	1
17 Aug	38	226	74	1	117	42	0	0
21 Aug	16	92	31	34	7	19	0	0
22 Aug	20	355	228	17	61	57	12	2
24 Aug	16	579	79	0	32	130	9	5
Total		2404	998	39	503	862	43	9
Unidentifiable/night		2.46 ±	9.93	3.9	50.3	86.2	4.3	0.9
Detectable/turbine		26.7	11.1	0.4	5.6	9.6	0.5	0.1
Extrapolated total/night		30,090	4,192	164	2,111	3,120	172	39

Table 2. Objects detected with each of 3 thermal infrared cameras aimed at different parts of a wind turbine rotor-swept zone at the Mountaineer Wind Energy Center in West Virginia, USA, in 2004.

	No. of observations from each camera			
Object	Camera A	Camera B	Camera C	Total
Bats	389	244	548	1,179
Insects	146	113	211	500
Birds	19	1	6	26
Aircraft	0	2	1	3
Unknown	343	344	668	1,356
Total	896	704	1,434	3,064



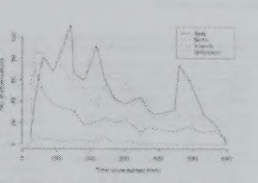


Figure 3. Total number of bat, bird, and insect passes per night for 30 nights between 6 August and 24 August 2004 based on thermal infrared images recorded at the Mountaineer Wind Energy Center, West Virginia, USA.

Figure 5. The mean number of bats, birds, insects, and sun categorized above), observed with thermal infrared cameras over time during 6 nights in August 2004 at the Mountaineer Wind Energy Center in West Virginia, USA. Bar intervals (pink) during the first 3 hours after sunset.

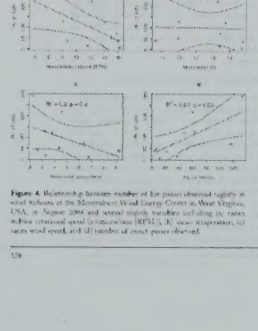


Figure 4. Relationship between number of bat passes observed nightly at wind turbines at the Mountaineer Wind Energy Center in West Virginia, USA, in August 2004 and several nightly variables including (a) mean turbine rotational speed (revolutions per minute [RPM]), (b) mean temperature, (c) mean wind speed, and (d) number of insect passes observed.

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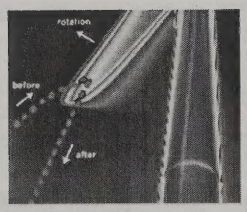

Figure 6. A time-lapse series (temporal interval changes taken of a bat being struck by a blade of a wind turbine at the Mountaineer Wind Energy Center in West Virginia, USA, in August 2004. Twenty-one sequential frames at video rate (shown at the bat just before and after collision with a rotating blade. The bat approaches the area swept by the turbine blades on a curving trajectory before contact, but its heading and speed are rapidly changed as the bat is accelerated toward the ground. For clarity, the position of the wind turbine (hub + shown only for the single frame of video in which contact occurred.

turbine blades were rotating at or near peak angular velocity (17 m/sec; Table 3).

We also observed a variety of what we judged to be exploratory behaviors by bats. Bats often make several check passes before alighting on and entering roost structures such as trees and buildings. We frequently observed bats making check passes or making repeated flight loops near moving blades. On 4 separate occasions, we also observed bats executing check passes and briefly alighting on the nacelle roof. This usually occurred at approximately one half to two thirds of the height of the hub. This behavior was particularly well illustrated in one instance when an individual bat, while investigating the length of a motionless turbine blade, made several check passes before briefly alighting on the blade surface, approximately two-thirds down the length of the blade toward its distal end. We also observed 3 instances of bats either chasing the tips of slow-moving blades, or perhaps being drawn into a blade-tip vortex during low-wind conditions when turbine blades were rotating slowly.

DISCUSSION

Several hypotheses have been advanced about how and why bats are killed at wind energy facilities (Kunz et al. 2007*b*). Many of these hypotheses focus on the idea that bats are in some way attracted to wind turbine areas or to turbine structures, and the result is a greater than normal probability of being struck by a moving blade. Indeed, in a companion study conducted at the Mountaineer facility at the same time as the current study (Kerns et al. 2005), searchers walking daily transects beneath every other turbine found 466 dead bats in 42 days (11.1 bats/night or 0.26 bats/turbine/night). Given that searcher efficiency during the study was uncovered at 25%, the actual rate of mortality at the facility is likely much higher. Although the density of bats in the region around the facility is not known, this rate of mortality seems to suggest that bats are more abundant near turbines. The present study generally supports this hypothesis by providing some of the first evidence that collisions may be nonrandom interactions between bats and moving turbine blades.

The large variation in numbers of both bats and insects that we observed on a nightly basis and the significant correlation between insect and bat activity suggests that bats may be attracted to patches of insects, although weather patterns may amplify this relationship. Modifications to the forested landscape that results from construction of wind energy facilities, including the creation of open space in which turbines are installed and the forest landscape along access roads, may create favorable foraging grounds for insectivorous bats (Kunz et al. 2007*b*). Forest edges may be favorable to insect activity and to the ability of bats to capture them in flight. Migratory flights also may account for increased bat density around wind farms as individuals or groups of some species make stopovers to feed, drink, and roost in trees (Fleming and Eby 2003; Cryan and Brown 2007). As with resident populations, migrants or groups of bats making stopovers may be similarly attracted to these areas to feed.

In addition to attraction to wind power facilities, it is possible that locally foraging bats also are attracted to some attribute of the turbines themselves. Ultrasound emissions may attract the curiosity of bats (Kunz et al. 2007*b*), although recent investigations suggest that sounds produced by at least some wind turbines likely do not attract bats (J. Szewczak, unpublished data). Although the results show that there is no significant difference between the levels of bat activity at lighted versus unlighted turbines at the Mountaineer Wind Energy Facility, light sources may attract insects to some wind turbine sites.

Perhaps the most important observations of this study were those of bats actively investigating both moving and motionless turbine blades. This bats-eyed view and investigated turbine blades and monopoles suggests that they may indeed be attracted to wind turbines themselves. One possible hypothesis to explain this behavior is that bats view these tall structures, standing in open space, as roost trees (Kunz et al. 2007*b*). Forest bats often seek out large trees and snags as desirable roosting habitat (Kunz 1982, Vonhof and Barclay 1996, Kunz and Lumsden 2003). The openings and forest edges that wind sites provide may represent favorable conditions for roosting and foraging, even for migrating tree bats during stopovers. Migratory bats also may investigate wind turbine structures in an attempt to evaluate their potential as mating sites (P. Cryan, United States Geological Survey, personal communication). It is unknown why bats might choose to investigate or pursue moving blades, but since they engage in such

Life could reduce fatalities considerably, with potentially modest reduction in power production and associated economic impact on project operations. Future studies employing TIR cameras have the potential to answer some pressing questions about the cause of bat fatalities at wind turbines. Moreover, employing TIR imaging during planning and development of new wind power facilities has the potential to inform developers and decision makers about the abundance, frequency, duration, and types of bat activity.

ACKNOWLEDGMENTS

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Table 1. Wind speed at nacelle and bats' estimated flight speeds at time of contact with moving turbine blades, Mountaineer Wind Energy Center, West Virginia, USA, August 2004. RPM indicates revolutions per minute.

Date	Wind and turbine speed at times of contact with bats			
	Time (hr:min:sec)	Turbine rpm	Turbine speed (RPM)	Wind speed (m/sec)
24 Aug	23:11:12	19	17.1	8.4
24 Aug	1:29:20	16	17.5	8.6
25 Aug	1:15:56	20	17.1	7.1
25 Aug	3:03:29	20	17.1	7.5
26 Aug	23:39:17	01	1.5	0.0

behavior, they may be caught by vortices that form in the wake of the blades (Kunz et al. 2007*b*, National Research Council 2007). This curious and exploratory behavior increases the probability of a collision with a moving blade over random encounters.

We observed bats primarily feeding and foraging around and in the rotor-swept zone of the turbine. Our results do not show that bats are struck by turbine blades while passing through the wind energy facility in straight-line flight en route to other destinations. To understand this relationship more fully, future investigations will need to monitor fluctuations in bat abundance aloft throughout the entire season (Apr–Oct in temperate regions).

That bat activity was so highly variable on a nightly basis suggests that stochastic variables such as weather conditions may affect their abundance. Because insect abundance is ephemeral and dependent on weather patterns, bat activity and the likelihood of being struck by rotating turbine blades could be predicted by a combination of insect seasonality and local weather patterns. The lack of statistically significant effects of temperature, barometric pressure, and wind may be due to the small sample size ($n = 30$). However, data from carcass searches obtained in a parallel study suggest that fatalities increased on low wind nights (Kerns et al. 2005), times when insects generally are most active.

There are some important limitations to the interpretation of these data. Based on our conservative classification scheme, we consider our estimates of bat activity to be reliable and the number of false positives to be low. However, identifications were a challenge given the varying weather conditions and the geometric problem of maximizing the field of view of the cameras without reducing our ability to resolve flying bats, particularly those at middle to high elevations. Low fog and cloud cover are common at the Mountaineer facility, and although infrared light is less scattered by water vapor than visual wavelengths, fog and cloud cover nevertheless reduce visibility and clarity in the images. Thus, to a certain extent, the number of objects observed may tend to be auto-correlated with low fog and cloud cover. This is partly due to the limitation of the camera's capacity to clearly resolve bat-sized objects at distances about the reach of the turbine's blades. Deployment of TIR cameras with higher resolution sensor arrays would greatly reduce this problem in future studies.

This study revealed some important considerations for future research. We originally designed the study to test the effect of slowing or stopping blade rotation on bat behavior around turbines and on the number of fatalities. However, we were unable to execute this experiment because the operators of the facility reserved their decision to allow us to experimentally stop rotation by feathering the blades at predetermined times. Future studies should include experimental control of blade rotation (including stopping rotation) to separate the effect of rotation from the effect of the existence of the tall turbine structures themselves. This should be done with the same budget of nightly bat foraging in mind, so bat abundance may decrease after an initial bout of foraging (Kunz 1982, 2004; Kunz and Lumsden 2003) and then later increase with foraging periods in the early morning (Kunz 1973, Eckert 1962). Future studies should also compare levels of bat activity between turbine areas, deforested areas at wind energy facilities without turbines, and adjacent forested areas. This comparison is necessary to separate the effects of landscape modification created during turbine facility construction from the effects of the turbines themselves on bat activity.

Future research must also gather observations for the full length of the season (early spring through late autumn) in which bats are active in order to address the effects of transient populations and migration, as well as the presence of resident bats. Finally, to better understand factors that may contribute to fatalities, it will be important to determine what actually happens to a bat in the moments before it is struck by a rotating turbine blade (Kunz et al. 2007*b*). Our results indicate that in many cases bats successfully avoid moving turbine blades. However, the infrared images that we collected were limited in resolution and detail. Bats close to rotating blades are between 41 cm and 114 m from the camera, and appear as objects of 2–10 pixels in size. To resolve the interactions in finer spatio-temporal detail, >2 high-resolution cameras should be used to capture synchronized stereo images, from which 3-dimensional spatial models can be constructed. Such visualization could provide, in each instance, the distance that bats are from blades, how bats avoid blades, and what factors contribute to collisions that could suggest important mitigation strategies.

MANAGEMENT IMPLICATIONS

These findings have implications for mitigating bat fatalities at wind facilities, and investigations of nightly activity can help to evaluate the responses of bats to operating wind turbines. A primary finding of this research is that the nightly distribution of bats aloft is nonuniform. We found that most of the bat activity near wind turbines occurs in the first 2 hours after sunset. This observation, combined with the finding that weather patterns and nightly availability of insects may be reliable predictors of bat abundance suggests that collisions of bats with wind turbines could be greatly reduced by focusing mitigation efforts (such as turbine blade feathering) on periods of high bat activity. Curtailment of operations during predictable nights or periods of high bat

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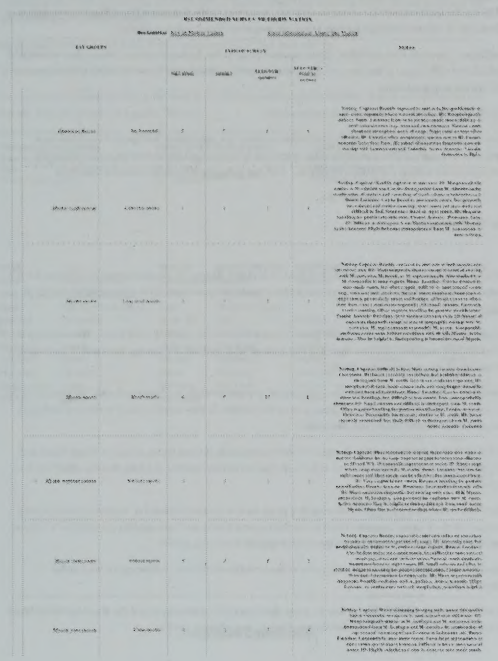

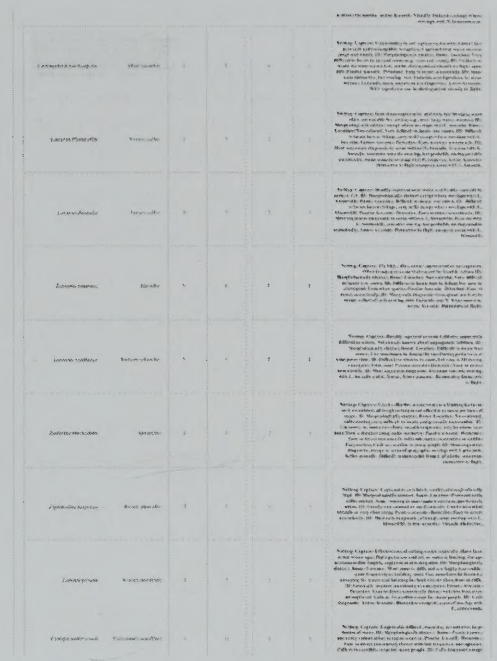

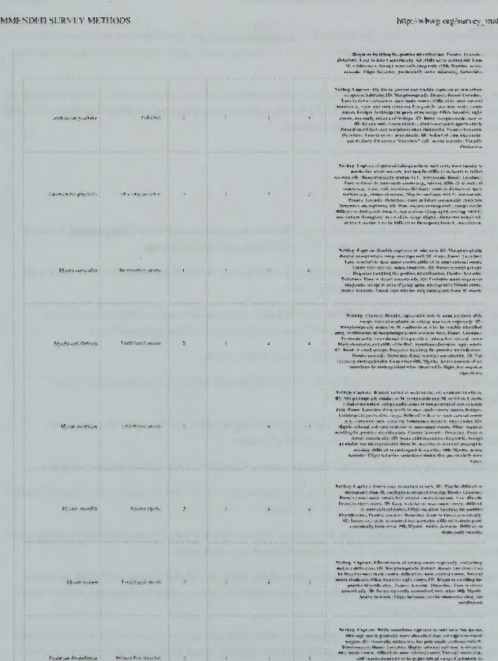

Wind farms and deadly skies

Turbines on Texas coast killing thousands of birds, bats each year.

By Cain McDonald / cmcdonald@express-news.net
Updated 12:31 a.m. Sunday, February 27, 2011

SARITA — The 260-foot-tall wind turbines of the Kenedy Ranch stand like a steel forest along the edge of the Laguna Madre and pump out hundreds of megawatts of emission-free electricity.

The spinning blades, alongside some of the most important habitat in Texas and one of North America's largest migratory flyways, are killing thousands of birds and bats each year.

How many isn't publicly known because, unlike California counties, Texas and the federal government don't require turbine operators to make public reports, according to state and federal officials.

Aside from the quantity of bird and bat deaths, a more complicated question remains unanswered as more wind turbines are put up along the Texas Coast: Have the turbines changed the ecosystem and displaced wildlife?

For the first time, Pattern Energy, which owns 118 turbines on the ranch, and Iberdrola Renewables, which owns 168, voluntarily released results of their first yearlong studies.

Pattern estimates up to 921 birds and 2,300 bats were killed between Aug. 24, 2009, and July 31; Iberdrola's estimates: 1,812 birds and 3,087 bats for the same period.

While the bird killings match the national average, one researcher found the bat killings much higher than expected.

Those who opposed the wind farms are not convinced the studies are credible or conclusive.

The work was paid for by the companies and not peer-reviewed. In their reports, biologists wrote about the challenges of collecting good data with rattlesnakes biting their search dogs and cows that would not leave. The researchers estimate scavengers removed half of the bird and bat carcasses before they could be found.

They also could not get federal permits to collect the species they did find, so many had to be marked as unknown.

After more than a year of submitting forms, the companies received a collection permit last month, said Rick Greiner of Pattern Energy.

But of the species identified, none were endangered.

"We think there is a low impact to T and E (threatened and endangered species) because we have not found any," he said.

The reports state the wind farms had a bird mortality rate of three birds per megawatt, which is in the middle for the national average of one to six birds, according to the American Wind Energy Association, a trade group. A national average for bats killed per megawatt is not well-established.

In addition to average bird mortality, the companies point to the high-tech radar systems they voluntarily installed that will trigger a shutdown of the spinning turbines during fog or low visibility when a mass of birds or bats is approaching.

As of the end of 2010, a shutdown had not occurred.

"At every stage of the project's life, Iberdrola Renewables has gone above and beyond what has been required by the state of Texas and federal government to conduct extensive studies and monitor the outcomes of our wildlife protection measures," said Jan Johnson, a spokeswoman for Iberdrola.

More than numbers

One who disagrees the studies have been extensive is David Newstead, an environmental scientist for the Coastal Bend Bays & Estuaries Program in Corpus Christi and president of the Coastal Bend Audubon Society.

He believes mortality rates are an incomplete measurement of the effect of wind farms. The numbers do not reflect how turbines could be changing behavior of birds and bats by forcing them out of their habitat and putting them under greater stress.

"Cumulative effects are practically never discussed by wind developers," Newstead said. "At the end of the day, the most important numbers, for the sake of the wildlife, is how many of what species of birds and bats are being not only killed, but displaced."

Newstead is one of most vocal challengers to the construction of wind farms along the Texas Coast and was part of an unsuccessful lawsuit to stop them, funded in large part by the King Ranch, which borders the Kenedy Ranch.

"There is no other place in North America that plays such an important role for so many species during some part of their lives," Newstead said about the Laguna Madre and surrounding grasslands. "Collision mortality can thus affect any of more than 400 regularly occurring species."

Newstead's concerns for the coast only grow as more turbines are built, following the lead of the Kenedy Ranch.

Since the Kenedy turbines came online in 2009, Iberdrola has added more, and the Papalote Creek Wind Farm with 196 units was built outside Corpus Christi, according to AWEA.

When operating at capacity, the Kenedy Ranch turbines in total can generate close to 680 megawatts, or enough electricity to meet the needs of 145,000 to 170,000 homes, according to CPS Energy, which buys power from Iberdrola.

That power is produced during the day when consumer demand is the highest, and it can be delivered via uncongested transmissions lines, said CPS Energy spokeswoman Lisa Lewis, adding that effect on wildlife was not considered when it signed the contract.

Working with wind

For now, wind companies face few consequences for killing wildlife, explained Paul Schmidt, assistant director at the Migratory Bird Program for the U.S. Fish and Wildlife Service.

While it's against federal law to kill or harm any endangered, threatened or migratory bird species, the agency has not prosecuted any wind farm owner.

Instead, the service is working with the wind industry, scientists and conservationists to establish guidelines for how wind companies should place and operate a wind farm, Schmidt said.

A draft of those guidelines was released for comment this month.

Once the guidelines are adopted, the Fish and Wildlife Service will have a basis to decide which companies to investigate, Schmidt said.

"It's just like you're driving down the highway and the speed limit is 55," he said. "You can go 60, probably 62, but at some point you are going to get caught."

Schmidt said companies that volunteer information will avoid the scrutiny given those that do not.

Pattern and Iberdrola have regular communication with the service. But the reports they send are marked "privileged and confidential," so they can't be shared.

When Pattern gave its reports to the San Antonio Express-News, it called them public but then requested it preapprove anyone who saw them and that they not be posted online.

"Clearly we have a problem with transparency with the wind and wildlife issues, and I think we have a ways to go," said Edward Arnett, director of programs at Bat Conservation International, whom Pattern approved to review its studies.

With wind farms across the country reluctant to share data openly, the understanding of the cumulative effect on wildlife and the best way to minimize it are stunted, Arnett said. This is especially true of bats.

At 150 feet long, the wind turbine blades move between 100 and 180 mph at their tip. The pressure change on the trailing edge is enough to cause internal hemorrhaging in bats, according to Bat Conservation International.

Before the Kenedy wind turbines went in, Arnett had expected low bat mortality, as there were no known concentrations of bats in the area. Since so little is known about bat movements, he is not surprised the numbers turned out to be higher.

Before wind turbines were built, little was known about bat movements.

It isn't possible to know what is and isn't working, he said.

"Until we have the information published in a credible fashion that is publicly shared and published in journals, it is going to be unknown," he said.

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From: Atul Kumar [mailto:gm@brawleyinn.com]
Sent: Friday, October 07, 2011 10:55 AM
To: BLM_CA_Ocotillo_Express_Wind_Project; angelinahavens@co.imperial.ca.us
Subject: Ocotillo Wind Energy Project

caocotillo@blm.gov
angelinahavens@co.imperial.ca.us

It is my pleasure write a letter in support of the proposal of Wind Energy Project being submitted to the
Imperial Valley by Pattern Energy.

P345-01

I fully support the efforts of the Wind Energy Project by Pattern Energy as they seek external funding to support a project designed for Imperial Valley.

Sincerely,

Atul Kumar
General Manager
Brawley Inn Hotel & Conference Center
www.brawleyinn.com
gm@brawleyinn.com

Comment Letter P346

From: scotty baldwin [mailto:scotty_baldwin@mac.com]
Sent: Friday, October 07, 2011 9:29 AM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: "Ocotillo Wind Energy Project"

the Ocotillo Express Wind Farm clearly threatens the health and diversity of thousands of acres of fragile desert ecosystem Please pass on this project and preserve what has been preserved for all of us thx scotty

P346-01

Comment Letter P347

From: EwingDuo@aol.com [mailto:EwingDuo@aol.com]
Sent: Friday, August 26, 2011 9:00 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Wind Energy Project

My name is: Parke Ewing (Ewingduo@aol.com)
PO Box 84, 98 Imperial Hwy.
Ocotillo, Ca. 92259

Re: Ocotillo Wind Energy Project, on page 48, 3rd paragraph, states that "no" Peninsular bighorn sheep have been documented on flat desert terrain between 2009 and 2011. Me and three of my friends saw 7 bighorn sheep just north of the local dump in 2009. Please consider our sightings as documented in the future final draft report.

P347-01

Thank you;
Parke Ewing

Comment Letter P348

From: loconoco@netzero.com
To: Angelina Havens
Date: Tuesday, October 04, 2011 6:36:16 PM

SAYING NO TO BOTH BLM AND PATTERSON ,DONT NEED YOU! WE USE IID

P348-01

57-Year-Old Mom Looks 25
Mom Reveals $5 Wrinkle Trick That Has Angered Doctors!
http://thirdpartyoffers.netzero.net/TGL3241/4e8bb4f1f3ffd7d548fst05vuc

From: mark.l.meech@cummins.com [mailto:mark.l.meech@cummins.com]
Sent: Tuesday, October 04, 2011 7:37 PM
To: BLM_CA_Ocotillo_Express_Wind_Project
Subject: Ocotillo Wind Power Facility

Dear Mr. Perry,

I hope that these comments hit home and make sense out of something that has so many impacts on so many people and creatures. Please work for us, the people that are depending on you to preserve these lands for future generations. I apologize for the confusing e mails. I had some issues with Yahoo. This is the letter for comment on the draft EIR/EIS

Regards Mark Meech
Ocotillo Ca.

Bureau of Land Management

October 1, 2011

Mr. Cedric Perry

Subject Ocotillo Wind Energy Project

Starting with the very first page of the draft EIR/ EIS sets the tone for this project. Reference ES-1 "Proposed Action Alternative 1" It states that the project would be a 465 MW project with 315 MW coming from 137 WTGS. That is an estimated 2.29 per WTG. As it continues on it states that the other 150 MW would come from an additional 18 WTG's or 8.33 per WTG. How large would those be? From the very beginning the BLM and Pattern must have thought that none of the people would take the time to read this material. Pattern started off by telling us that this project would produce enough power for 300,000 homes. When challenge to do the math they stated it would be enough for 140,000 homes. But when you do the math that means the wind would have to be blowing 28mph 7 days a week 24 hours per day. When using the tools that are available you will find that this project would produce about enough power to supply power for about 50,000 homes only 29 days per year. Please understand this. I am for doing something about our energy crisis but we have to do the work and build the products that will get us the most power for the money spent. We have heard about the billion dollar project from Pattern, but let's face private industry could not nor would not do this because it makes no sense. The land and environment that will be destroyed for such a project can not add up to what would be gained. This is a money scam like so many before it and so many after it. There will be many investigations to name the blame game for such a mess. There are many miss stated facts in this EIR/ EIS. What about the Cultural Resource impacts. I have been coming to this area for many years and I know what is out there. There are reasons for limited use areas. Why do we need to make changes to the California Desert Conservation Act to make such a project happen? I know that you know what "conservation " means.

P349-01

P349-02

- Conservation:
- 1 the act or an instance of conservation or keeping from change, loss, injury, etc
- 2 a. protection, preservation, and careful management of natural resources and of the environment.
- b. (as modifier): a conservation area

There are so many cultural resource locations that any archaeologist would tell you that this area is not suitable for any such project no matter the size. I have issues with the Cultural Resource section and the miss stated facts of this area. We have thousand of locations identified and for this project to say that only ten percent of the area would affect them is just not true. Here are some comments from Archeologist that have spent time here with us.

P349-03

"This area is rich in cultural resources"

"This area has exploded with findings"

"The findings would drastically change the scope of the project"

The BLM and the County of Imperial should know this. We know this and we are not experts in this field. If you do not you should ask Pattern for full discloser so you could have a better understanding of what you are talking about destroying. We know what the Native American populations are prepared to do to protect their heritage and we support those actions. This fight has brought so many different types of people together for a common goal. These types of projects must be stopped to maintain the resources for future generations.

P349-03, cont.

Water: Federally Protected Sole Source Aquifer

Without this water protection we have no town. Many others depend on this as well. Do we need to tell you what protected means? It means you should not be constructing an industrial area on top of it. We know that the water is low as 38 feet deep in some area and as much as 140 feet from the surface. It runs under the ground through sandstone. If it collapses or is damaged in any form we could be without water. We have brought it to your attention that these WTG hold as much as 800 liters of oil for cooling. It is very well documented that these WTG's have seal failures that would allow this oil to leak out and fall to the ground. We have also discussed with you and Pattern our concerns about fires from seal failures. These are very well documented. What guarantees will BLM give us none of this will happen. It must be a concern for Pattern because they are now going to many groups in the community and boasting about oil containment for the transformers that hold far much less that the WTG's. When Pattern was asked about oil containment from a seal failure they said" the oil will fall to the concrete pad below the WTG and would not make it to the water table" What kind of oil containment is that? It is not! This is not about protecting anybody from anything it is about money, that is the only part of this that is green.

P349-04

Wildlife Impact:

- 12 endangered species
- 7 threatened species
- 1 rare specie
- Peninsular big horn sheep
- Desert tortoise
- Flat tailed horned lizard
- Gecko lizard
- Golden Eagles Federally protected
- 7 red tailed hawks near several MET towers
- Migratory birds
- Bats
- Red tailed fox
- Road runners
- Desert iguanas

P349-05

Every day you read more and more reports of bird kills from WTG projects. I have attached for your reading some information regards this. The EIR/EIS made very little of the Peninsular big horn sheep that come in and out of the western side of this project. We have been tracking their activities for years in this area but yet another time the EIR/EIS blows it off. You should spend some time with your neighbors, Anza Borrego State Park. Many of the rangers did not even know of this project and its location. Great job of including them in the impact of this proposed project. Why is there not an EIR/EIS for the State Park? I can only assume this project would hit a brick wall if everybody knew about it.

Earthquakes:

Yet just over the last few days we continue to have more 3.0 quakes. I know Pattern will tell you about how strong these WTG's are and have withstood very large quakes in Chile. One thing that is not the same as Chile is the ground. Sand on top of a cavity of air and water (aquifer) inside of sandstone walls. How much does 320 yards of concrete weigh? How much is a complete WTG weight? The EIR ? EIS cannot explore the facts enough in regards to this subject. This is the wrong technology in the wrong area. I know that further investigations may delay the payment plan for Pattern and that may make it not financially feasible but when one of these monsters falls over on a family out for a ride one weekend who will the public look to for answers?

P349-06

Water for construction. Dust mitigation.

Already you can see the public back lash about using water for such projects I have attached a story from News 10 in San Diego in regards to the transportation and concerns of using potable water for such things. We have been through several years of water conservation regulations yet you are going to approve millions of gallons of potable water to be wasted for such projects. Is this still about money? What about the impacts of just transporting such large amounts water? Not much is discussed in the EIR/EIS in regards to air pollutions with heavy duty diesel powered class eight trucks. The NOx and Particulate matter for this area will take many years of to recover. People with any repertory issues will suffer.

P349-07

Dust Pollution:

This subject is very concerning since we now have a track record of how the industrialization of this area is being handled currently. We have many pictures and videos of the "lay down yard "located off of S2 just west of Ocotillo. We have complained to BLM, County APCD and nothing is done about it. Both BLM and the County say it is the others area to regulate. Let's face it there will be no regulating such a project. This is a very small area and dust con not be controlled here. Nothing to the magnitude of what Pattern is proposing with miles and miles of new wider roads. 155 holes dug in to the earth. What happens to 320 years of dirt that comes from each hole? No mention of what happens to this. Please explain what will happen to this dirt? Will it be stored some place for 20 years and then put back in to the holes when the WTG's are removed? Once you break that desert crust of the soil it takes about 300 to 400 years to form as it was. How can this concern be mitigated? What about cases of Valley Fever in Arizona from such projects and what they do to the land. What mitigation can be done for this?

P349-08

Surface Water Flow:

We are located in or near the FEMA flood plain, area.

Effects of new construction to the flow of surface water, unknown.

Major rains could do substantial property damage to homes and properties.

New forms of erosion could also affect or aquifer. Pattern has all of the answers but no practical experience in such areas. This is a natural land form, not the flat lands of Texas.

P349-09

Traffic

5000 heavy duty diesel powered water trucks to bring 25,000,000 gallons of water in.

7930 heavy duty diesel power cement mixers to construct the bases for the towers

2196 heavy duty diesel trucks to bring towers, blades, turbines, and parts

20,400 gas or diesel powered vans for car pooling. If every employee car pooled

2196 trucks for blades maintenance. 244 x 3 x 3 = 2196. A San Diego company that repair blades say could be 2 or 3 time for the life of the project.

Heavy duty diesel engines emit NOx w hydrocarbons

Heavy duty diesels emit particulate matter

Heavy duty diesels emit green house gasses

Heavy duty diesels get 5 – 6 miles per gallon of diesel fuel a byproduct of fossil fuels.

P349-10

Only some of which has made it to the EIR/EIS. We are currently dealing with a small scale with Par Electrical and the water trucks, service trucks and employees working to the Sunrise Power Link. The noise, speeding vehicles, trash from out of the backs of the trucks, blown tire left of the road. Nobody wants to deal with it.The EIR/EIS is in place for this part of the project yet no officials will take control of it. The County APCD blows it off. The CHP will do nothing about the litter and trash. The CHP will do nothing about the speeding to down county roads near children's play areas. The County was so controlled by SDG&E they gave them a 7/24 permit to work. What mitigation will deal with these issues? Please list them with phone numbers and contact names.

Load Followers:

When Pattern is asked about this subject they say that they do not require them. Yet another lie. Every WTG project worldwide has a source for load followers. They have a power supplier agreement and must supply power when there is no wind (by the way 85% of the time) they will be depending on dirty power and sell it for clean power rates. Back to green, green money. These load followers burn fossil fuels. Nothing green about it. In fact the amount of these projects that are going on it will actually increase green house gases because of the need to increase consumption when there is no wind. Nothing green about this. Sounds like a scam, Solyndra and Evergreen, will we see Pattern next?

P349-11

Views and Vistas

Could there be a more sensitive area for such a project? I say not. When your are surrounded by Coyote Wilderness Area, Jacumba Wilderness Area, Anza Borrego State Park, Yuha Dessert , and Painted Gorge, all by the way are in the El Centro BLM top ten areas for Imperial Valley. How could you even consider such a project? There are many areas that such a project could work but most are south of the border and very remote. Our town will be surrounded 320 degrees of nothing but WTG's. Some view. What mitigation can take place for this issue? I know there is a sum of money or as Pattern says "enough meat on the bones" I say no way. Once something like this happens there is no going back. It must be alternative #5 should take care of this portion of mitigation.

P349-12

Historical Area

De Anza traveled through this area and left many areas of historical significance

Native Americans, historical sites too many to list. This information is confidential and cannot be disclosed publicly

Need EIR/EIS to report substantial findings for the protection of the area.

Desert View Tower California Historical Landmark #939 and the impact for every visitor that would come to "view the desert" The view would be a ravaged area that has WTG's. Not what our ancestors asked us to preserve for our future generations. Why do you feel compelled to destroy it? What mitigation can take place to correct this wrong. Please list it and how much "meat on the bones" would that be.

P349-13

Hazardous Waste

Look at all of the local WTG projects and all of the good intentions. Yet we are stuck with visual hazardous waste we must look at every day. Campo WTG project and the junk that has been laying there for years. Look all up and down I 10 in Beaumont down into the valley the just and equipment that is left there. What are these projects and the EIR/EIS going to address in regards to that issue. I see nothing that protects the public and the public land from destruction. How much hazardous waste will be produced annually from Ocotillo Wind Energy? What will they be permitted for? They will have to have a hazardous waste generators permit. What will it say? How can mitigation deal with this? Alternative #5 that covers this issue as well. 600-800 liters of oil, how often do they have to change it? Is this a green project or is it a project looking for green. We do know the answer to that.

P349-14

Environmental Justice

We are economically a poor community. We cannot afford to fight big industry. We cannot fight the industrialization of the land around us. We need protection from private industry destroying our quality of life. What and how can this be addressed? There is nothing in this EIR/EIS to deal with this issue. Yet it must be considered. Just because we cannot afford the resources that Pattern has, to get this project stopped why do we have to fight the very people that are deemed responsible for protecting this land, the Bureau of Land Management? You need to take action and push the only alternative, and that is #5. How can mitigation deal with this issue when there is no format that brings this into consideration? You must choose alternative #5 in this case.

P349-15

Federal Good Neighbor Act

Is there such a thing? There should be. The federal government needs to be a good neighbor with facilities and land use. Be responsible, do the right thing manage our lands for future generations. Had the people before you done such tings there would be nothing left for you to manage. The lands would be gone and industrialized. Private industry taking advantage of starving government agencies that have little to no power and or funding. We all need to stand up and say Alternative #5 is the choice for this project. Patterns take your government funded programs and go to Wyoming with the rest of the wind projects that are looking to sell power to those poor folks in California. I have attached information in regard to the surplus wind power from Wyoming. California does not need another dying WTG project, killing of animals, birds and humans.

P349-16

Health Concerns

- Shadow flicker
- High frequencies noise
- Low frequencies noise
- Wind turbine syndrome
- Electromagnetic fields EMF
- Air pollution from construction, dust, diesel
- Many studies being done in Canada, Holland, Washington state, Oregon
- Valley Fever

P349-17

In closing, I am asking for you to select Alternative #5 from the draft EIR /EIS because it will protect these lands for future generations. The United States of America is a rich nation. Not only rich in money but talent, inventions, creators, technical experts, workers ready to build exciting new things to help our country and world. People come from all over the world to view such things as these very lands we are discussing. Do not destroy them they can never be replaced or repairs once you do. We have so many other choices for such projects. Wyoming is begging other states to buy the renewable power, there is no need for more destruction of OUR public lands. Does the right thing stop this travesty before it starts.

P349-18

Regards Mark Meech

Ocotillo Ca.

From:	Mark Meech
To:	Cedric Perry; Cedric Perry
Cc:	Jack Terrazas; Gary Wyatt; Michael Kelley; Ray Castillo; John Benison; Angelina Havens
Subject:	Ocotillo Wind Power Facility
Date:	Tuesday, October 04, 2011 5:38:13 PM
Attachments:	OEWT Concerns sat 2 Jan 2011.docx Mars Hill Wind Turbine Project Health Effects Preliminary Symptoms Survey Results.mht.msg Mars-hill nissenbaum.pdf Samuel Milham MD.docx 12000 ac Wind Project Desert Gazette.mht.msg I 10 west wind substation 2009,2011 ground current.pdf Diseases of civilzation and Dirty Electricity[1].pdf Evaluating the impact of wind turbine noise on health-related quality of life Shepherd D McBride D Welch D Dirks KN Hill EM.msg Viejas - BLM Ocotillo Wind 9-27-11[1].pdf Viejas ACOE OW 9-16-11[1].pdf Viejas -Salazar deny Tule & OTW 9-9-11[1].pdf Viejas to BLM Ocotillo Wind 8-25-11[1].pdf

Dear Mr. Perry,

Please see my list of concerns referencing the Ocotillo Wind Energy Facility draft EIR/EIS . The attachment is named " OWET Concerns set 2 Jan 2011". I have several attachments with information regarding several issues. Cultural Resource impacts, Concerns from Native Americans, Health concerns, that I hope will inform you of the many concerns such a project brings. I am sorry for the many attachments but with so little time we must make an impact in this decision process. There is much at stake for all.

P350-01

Thank you for your time and considerations

Regards Mark Meech
Ocotillo Ca.

To whom it may concern January 14, 2011

Ref: Ocotillo Express wind Turbine project.

Has Pattern applied for any type of grant, Federal, state, or local? **P350-02**

Who owns Ocotillo Express? **P350-03**

How long has Pattern Energy been in business? **P350-04**

County height regulations currently are how many feet? **P350-05**

We are in earthquake alley. What are the towers rated for on earthquake standards? **P350-06**

Military flight patterns, these are in the flight pattern, and what concerns do they have? **P350-07**

What is disclosed in Patterns hazardous waste generator license?

How much hazardous waste will they generate annually? **P350-08**

Are there any current regulations on how far from residential areas a turbine should be located? **P350-09**

How many of the 17- 20 permanent jobs will be filled by current Pattern employees? **P350-10**

Access is described as via I-8, Hwy 98 and S2. Do they plan to come through the town of Ocotillo? **P350-11**

What is the expected life of the blades on a wind generator?

How long do they get out of a blade before it needs normal maintenance? **P350-12**

Do they need to change out the oil on these turbines at so point in its life?

If so how many times in 30 years? **P350-13**

How many current Pattern employees will be included in the estimated 300 construction jobs?

Do they have a list of job positions that are needed for the construction process?

What vocational skills will be needed for construction and how many of each? **P350-14**

Are the blades recyclable?

If yes who will do that?

If no what will be done with them and where will they go to? **P350-15**

What is the financial gain for BLM? **P350-16**

How is the County of Imperial prepared to deal with fire on the generators at 450 feet in the air?

Do they currently have the aerial equipment for such structures? **P350-17**

When will they have the equipment for such a fire?

How will the Imperial County Air Pollution Control District deal with the increased emissions from the construction and operation of this project?

Will any banking and trading credits be used to offset the NOx and particulate matter? **P350-18**

What will be the impact of additional green house gas be from the additional diesel powered trucks used n construction and operations of this project?

Estimated trucks for construction could be 3500- 5000 just for water transportation

Estimated trucks for just the components of the wind turbines could be as many as 2000 diesel powered trucks **P350-19**

Estimated transportation for maintenance of the blades could be as many as 6000 over the life of the project or more.

These are powered by diesel engines and burns 5-7 miles per gallon of diesel fuel. Is this calculated in to Patterns environmental foot print of this project? **P350-20**

What is the plan for area around the FEMA Flood Plain for storm water diversion? We almost lost out town in 1976. **P350-21**

Aesthetic impact, scenic vista' and scenic highway impacts for people traveling through this project area? **P350-22**

What are California State Parks recomendations for off road use in this California Conservation area? **P350-23**

What is the Department of Fish and Wildlife's position and issues of the environmental impact of such a large project? **P350-24**

What have reputable biologist written in regards to the impact of such a project on the surrounding areas of the project? Jacumba Wilderness, Coyote Mountain Wilderness area and Anza Borrego State Park? **P350-25**

Will there be blasting during construction of this project? **P350-26**

What have seismologist said about the new findings of another fault that runs through Ocotillo and the proposed project area? **P350-27**

What is the estimated tax income by the State of California?

What is the estimated tax income for the County of Imperial? **P350-28**

We would like to have a Property Guarantee in place for all of the current owners. **P350-29**

What can be done to cover all of our property for flood insurance in the case of flooding because of the changes to the terrain? **P350-30**

What will happen if Ocotillo Express goes defunct will Pattern step up and clean up what has been done? Many cases world wide of that situation.LLC limits Pattern from the liability. **P350-31**

We would like low frequency noise to be measured before and after if the project happens. Please address this in the EIR/EIS **P350-32**

What is the benefit for the town of Ocotillo? **P350-33**

What is the environmental impact of the surrounding wilderness area?

Anza Borrego State Park?

Jacumba Wilderness area? **P350-34**

BLM states that this project is 5 miles west of Ocotillo. This is not correct. It appears that it they wind turbines are within .5 miles of personal residence. What can be done to change this distance? **P350-35**

Many reports from around the world state that a wind turbine should be a minimum of 2 kilometers. In most cases it is suggested 3 – 5 miles from humans why is this project so close? **P350-36**

Pattern's POD says that 1.5x (450 x 1.5= 675 feet), the height of the tower is the boundary any property lines, will this be enforced? **P350-37**

Pattern's POD says that public roads will have a setback of 1.1 times the height, Will that be enforced? **P350-38**

I have read most of Pattern's POD and found almost nothing in regards to the health and safety of humans. Much is known about exposure to the wind turbines yet nothing addresses this in the POD. Why is that? **P350-39**

We have many residential, county and public lands within less than .5 miles. Why is that if there are now issues with these wind turbines? **P350-40**

Why would BLM let this happen? **P350-41**

2.8 in Pattern's POD s states that total area will be cleared of vegetation. Do they have any idea what an environmental disaster that will be? There is no form of water or dust control that will deal with this. Our residences are directly in the path of that. They have stated how much natural wind there is what do they think will happen? Is the ICAPCD prepared to deal with this issue like they had with the 600 acres on the south side of I8 that was cleared of all vegetation? It is still drifting sand from the removal several years ago. **P350-42**

Will this project have any type of a "load follower"? These are fossil fuel fired devices to meet the suppliers contract to supply power to the grid. Every wind turbine project needs some type of load follower to meet these contract requirements. **P350-43**

When looking at all of the flowing green grass pictures in Patterns presentation with the big white wind generators I noticed one thing is missing in every picture, HOMES and PEOPLE. Why is that? **P350-44**

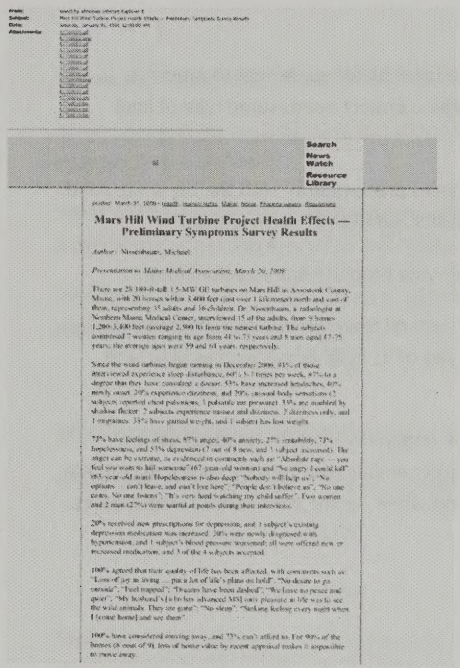
There needs to be a buffer zone of at least 2 miles from any private property line at a minimum. **P350-45**

Why is there not a Federal "Good Neighbor Act"? Should the Federal Government be expected to be responsible neighbors when their property impacts the lifestyles of its neighbors? Such as BLM land, military bases, etc... **P350-46**

I hope that the BLM, County of Imperial Planning Department, Imperial Valley Air Pollution Control District and elected officials are not all in this deal to make career ending decisions on such a magnitude. We will hold all of your feet to the fire so please remember this when signing your name to the project. **P350-47**

Mark Meech

Ocotillo Ca



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Mars Hill Wind Turbine Project Health Effects — Preliminary Symptoms Survey Results

Author: Nissenbaum, Michael

Presentation to Maine Medical Association, March 29, 2009

There are 28 100-0-kW 1.5-MW GE turbines on Mars Hill in Aroostook County, Maine, with 20 homes within 3,400 feet (just over 1 kilometer) north and east of them, representing 35 adults and 16 children. Dr. Nissenbaum, a radiologist at Northern Maine Medical Center, interviewed 15 of the adults, from 9 homes 1,200–3,400 feet (average 2,500 ft) from the nearest turbine. The subjects constituted 7 women ranging in age from 41 to 73 years and 8 men aged 47–75 years; the average ages were 59 and 61 years, respectively.

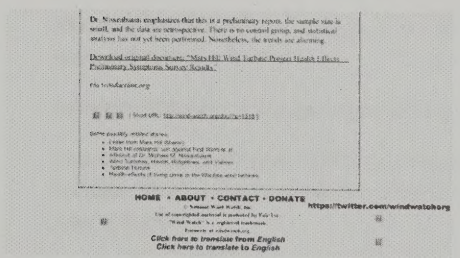
Since the wind turbines began turning in December 2008, 81% of these residents new experience sleep disturbance, 60% 1–3 times per week, 47% to a degree that they have consulted a doctor, 53% have increased headaches, 40% mostly onset, 20% experience dizziness, and 20% general body sensations (2 subjects reported chest palpations, 1 pediatric ear pressure). 33% are troubled by shadow flicker. 2 subjects experience nausea and dizziness. 2 dizziness only, and 1 migraines. 34% have journal weights, and 1 subject has lost weight.

73% have feelings of stress, 87% anger, 60% anxiety, 27% irritability, 73% hopelessness, and 53% depression (7 out of 9 here, and 1 subject recounted). The anger can be extreme, as evidenced in comments such as: "Absolute rage — you feel you want to kill someone"(67 year-old woman) and "So angry I could kill" (65 year-old man). Hopelessness is also deep: "Nobody will help us", "No options — can't leave, and can't live here", "People don't believe us", "No one cares. No one listens", "It's very hard watching my child suffer". Two women and 2 men (27%) were tearful at points during their interviews.

20% received new prescriptions for depression, and 3 subject's existing depression medication was increased. 20% were newly diagnosed with hypertension, and 1 subject's blood pressure worsened; all were offered new or increased medication, and 3 of the 4 subjects accepted.

100% agreed that their quality of life has been affected, with comments such as: "Loss of joy in living … put a lot of life's plans on hold", "No desire to go outside", "Feel trapped", "Dreams have been dashed", "We have no peace and quiet", "My husband's [who has advanced MS] only pleasure in life was to see the wild animals. They are gone", "No sleep", "Sinking feeling every night when I come home] and see them".

100% have considered moving away, and 73% can't afford to. For 90% of the homes (8 out of 9), loss of home value by recent appraisal makes it impossible to move away.



Dr. Nissenbaum emphasizes that this is a preliminary report, the sample size is small, and the data are retrospective. There is no control group, and statistical analysis has not yet been performed. Nonetheless, the results are alarming.

Download original powerpoint: "Mars Hill Wind Turbine Project Health Effects Preliminary Symptoms Survey Results."

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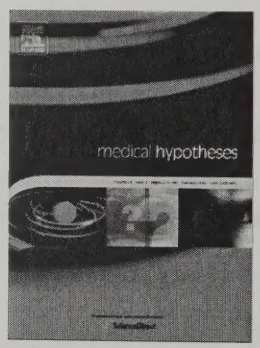
To whom it may concern:

Dirty electricity is a term coined by the utilities to describe high frequency voltage transients and harmonics riding along on the 60 Hz electricity provided in this country. It is generated by anything that interrupts current flow such as switching power supplies and inverters. It is a potent universal carcinogen. Wind farm electricity is generated at non-grid frequency , and uses inverters to change the generated electricity to grid frequency. These devices interrupt current flow and generate dirty electricity which travels in the earth and wires in the substation service area. I'm attaching an oscilloscope tracing of the ground current taken at a substation at the 110 wind farm. Also, The infrasound created by the windmill vanes make some people sick. I have written a book called "Dirty Electricity" describing the health effects of dirty electricity. I have measured the dirty electricity in the earth and air near wind farm substations and in buildings supplied with their electricity. It is always at levels which are a health hazard to nearby residents. Samuel Milham MD, MPH



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Historical evidence that electrification caused the 20th century epidemic of "diseases of civilization"☆

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SUMMARY

The close spread of residential electrification in the US in the first half of the 20th century from urban to rural areas revealed by 1940 in two large populations, urban populations with nearly complete electrification and rural populations exposed to varying levels of electrification depending on the progress of electrification in their state, it took until 1956 for US farms to reach urban and rural non-farm electrification levels. Both populations were covered by the US vital registration system. US vital statistics publications and century records for 1929–1982, and historical US vital statistics documents were examined. Residential electrification data was available in the US census of population for 1930, 1940 and 1950. Crude urban and rural death rates were calculated, and death rates by state were controlled with electrification rates by state for urban and rural areas for 1940 white resident deaths. Urban death rates were much higher than rural rates for cardiovascular diseases, malignant diseases, diabetes and suicide in 1940. Rural death rates were significantly correlated with level of residential electric service by state. The most causes examined. I hypothesize that the 20th century epidemic of the so called diseases of civilization including cardiovascular disease, cancer and diabetes and suicide was caused by electrification and by lifestyle. A large proportion of these diseases may therefore be preventable.

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Background

In 2001, Oststindex and [1] presented evidence that the childhood leukemia mortality peak in ages 2–4 which emerged in the US in the 1930s was correlated with the spread of residential electrification in the first half of the 20th century in the US. While doing the childhood leukemia study, I noticed a strong positive correlation between level of residential electrification and the death rate by state due to some adult cancers in 1930 and 1940 vital statistics. At the time, a plausible electrical exposure agent and a method for its delivery within residences was lacking. However, in 2008 I coauthored a study of a cancer cluster in school teachers at a California middle school [2] which indicated that high frequency voltage transients (also known as dirty electricity) were a potent universal carcinogen with cancer risks over 1420 and significant dose–response for a number of cancers. They have frequencies between 2 and 100 kHz. These findings are supported by a large cancer incidence study in 200,000 California school employees which showed that the same cancers and others were in excess in California teachers statewide [3]. Power frequency magnetic fields (60 Hz) measured at the school were low and not related to cancer incidence, while classroom levels of high frequency voltage transients measured at the electrical outlets in the classrooms accurately predicted a teacher's cancer risk. These fields are potentially present in all wires carrying electricity and are an important component of general current returning to substations especially in rural areas. This helped explain the fact that professional and office workers, like the school teachers, have high cancer incidence rates. It also explained why indoor workers had higher malignant melanoma rates, why melanoma occurred on part of the body which never are exposed to sunlight, and why melanoma rates are increasing while the amount of sunshine reaching earth is stable or decreasing due to air pollution. A number of very different types of cancer had elevated risk in the La Quinta school study. In the California school employees study, and in other teacher studies. The only other carcinogenic agent which acts like this is ionizing radiation.

Among the many devices which generate the dirty electricity are compact fluorescent light bulbs, halogen lamps, wireless routers, dimmer switches, and other devices using switching power supplies. Any device which interrupts current flow generates dirty electricity. Arcing, sparking and bad electrical connections can also generate the high frequency voltage transients. Except for the dimmer switches, most of these devices did not exist in the first half of the 20th century. However, early electric generating equipment and electric motors used commutators, carbon brushes, and split rings, which would inject high frequency voltage transients into the 60 Hz electricity being generated and distributed.

With a newly recognized electrical exposure agent and a means for its delivery, I decided to examine whether residential electrification in the US in the first half of the last century was related to any other causes of death. Most cancers showed increasing mortality in this period, and many are still increasing in incidence in the developed world.

Thomas Edison began electrifying New York City in 1880, but by 1920, only 34.7% of all US dwelling units and 16% of farms had electric service (Table 1). By 1940, 78% of all dwelling units and 32% of farms had electric service [4]. This means that in 1940 about three quarters of the US population lived in electrified residences and one quarter did not. By 1940, the US vital registration system was essentially complete, in that all the 48 contiguous United States were included. Most large US cities were electrified by the turn of the century, and by 1940, over 90% of all the residences in the northeastern states and California were electrified. In 1940 almost all urban residents in the US were exposed to electromagnetic fields (EMFs) in their residences and at work, while rural residents were exposed to varying levels of EMFs, depending on the progress of rural electrification in their states. In 1940, only 28% of residences in Mississippi were electrified, and five other southern states had less than 50% of residences electrified (Table 2). Eleven states, mainly in the northeast had residential electrification rates above 90%. In the highly electrified northeastern states and in California, urban and rural residents could have similar levels of EMF exposure, while in states with low levels of residential electrification, there were potentially great differences in EMF exposure between urban and rural residents. It took the first half of the 20th century for these differences to disappear. I examined US mortality records by urban and rural residence by percent of residences with electric service by state.

Hypothesis

The diseases of civilization or lifestyle diseases include cardiovascular disease, cancer and diabetes and are thought to be caused by changes in diet, exercise habits, and lifestyle which occur as countries industrialize. I think the critical variable which causes the radical changes in mortality accompanying industrialization is electrification. Beginning in 1979, with the work of Wertheimer and Leeper [5], there has been increasing evidence that some facet of electromagnetic field exposure is associated epidemiologically with an increased incidence of leukemia, certain other cancers and non-cancers like Alzheimer's disease, amyotrophic lateral sclerosis, and suicide. With the exception of a small part of the electromagnetic spectrum from ultraviolet through visible light, ultraviolet light and cosmic rays, the rest of the spectrum is man-made and foreign to human evolutionary experience. I suggest that from the time that Thomas Edison started his direct current electrical distribution system in the 1880s in New York City until now, when most of the world is electrified, the electricity carried high frequency voltage transients which caused and continue to cause what are considered to be the normal diseases of civilization. Even today, many of these diseases are absent or have very low incidence in places without electricity.

Table 1
Growth of residential electric service US, 1920–1950 (percent of dwelling units with electric service).

Year	All Dwellings	Farm	Urban and rural non-farm
1920	34.7	3.6	47.4
1925	53.2	7.9	66.4
1930	68.2	10.4	84.0
1935	70.0	12.6	87.9
1940	78.7	32.8	90.8
1945	85.0	49.0	93.9
1950	94.9	77.7	98.5
1955	96.8	93.3	99.2

Table 2
Percent of residences with electric lighting, 1930 and 1940 by state.

Code	State	1930	1940
AL	Alabama	23.9	43.1
AZ	Arizona	68.8	79.5
AR	Arkansas	23.1	32.9
CA	California	90.9	96
CO	Colorado	69.6	77.6
CT	Connecticut	95.8	96.9
DE	Delaware	78.4	89.8
FL	Florida	68.8	86.5
GA	Georgia	35.9	46.6
ID	Idaho	64.3	79.1
IL	Illinois	89.5	95.6
IN	Indiana	74.8	84
IA	Iowa	84.6	76.1
KS	Kansas	74	75.5
KY	Kentucky	34.2	54.2
LA	Louisiana	42.2	49.9
ME	Maine	76.1	89.4
MD	Maryland	83.8	87.9
MA	Massachusetts	97.1	97.9
MI	Michigan	84.8	92.1
MN	Minnesota	78.8	77.6
MS	Mississippi	19.4	28.1
MO	Missouri	69.5	78.6
MT	Montana	58.4	70.7
NE	Nebraska	73	70.5
NV	Nevada	79.2	86.6
NH	New Hampshire	89.9	97
NJ	New Jersey	96.8	98.9
NM	New Mexico	39.8	59.2
NY	New York	94.3	96.4
NC	North Carolina	40.8	54.5
ND	North Dakota	45.6	51.8
OH	Ohio	85.2	94.6
OK	Oklahoma	53.3	55.1
OR	Oregon	79.5	85.8
PA	Pennsylvania	89.5	95.2
RI	Rhode Island	97.3	97.5
SC	South Carolina	34.8	49.2
SD	South Dakota	46.4	50.6
TN	Tennessee	42	59.9
TX	Texas		59
UT	Utah	90.1	93.8
I	Vermont	71.9	80.2
VA	Virginia	58.3	69.6
WA	Washington	89.1	93.5
WV	West Virginia	51.8	68.1
WI	Wisconsin	74.1	83.6
WY	Wyoming	60	69.6

See data.

Table 3
Rural–urban residence and death rates per 100,000 by educational attainment.

Cause of death	ICD No.[a]	Urban rate	Rural rate	% Urban excess
All	1–999	1124.3	920.1	22.2
All cancers	42–45	145.8	92.2	58.2
Cancer, female	45	96.4	69.1	39.5
Other diseases of heart	440, 441, 443–447	247.8	192.8	28.5
	9–342, 4–7			
Diabetes	950–1	35.4	20.8	69.8
Suicide	163–164	17.3	13.2	29.5
Motor vehicle accidents	1–20	28.8	26.9	7.1

[a] 1958 Revision International Classification of Disease.

Table 4
Correlation coefficients for 1940 crude US death rates by state by metropolitan (by white residence) density.

Cause	ICD No.[a]	Residence	r	r^2	p (two tailed)	Slope	Y-intercept
All causes	1–999	Urban	0.063	0.003	0.295	0.007	13.134
		Rural	0.454	0.206	<0.0001	0.070	4.185
All cancers	45–55	Urban	0.867	0.745	<0.0001	0.883	75.102
		Rural	0.758	0.575	<0.0001	1.082	10.940
Respiratory cancer[b]	47	State	0.611	0.376	<0.0001	0.021	1.280
Breast cancer, female	50	State	0.398	0.159	<0.0001	0.128	1.306
Diabetes	1–1	Urban	0.606	0.444	<0.0001	0.236	0.748
		Rural	0.693	0.480	<0.0001	0.446	0.184
Leukemia[b]	204	State	0.575	0.331	<0.0001	0.021	1.301
Coronary artery	94	Urban	0.649	0.149	0.0014	0.494	61.530
Disease		Rural	0.282	0.418	<0.0001	1.252	25.310
Other diseases of the heart	400–51	Urban	0.446	0.182	0.006	1.196	109.45
	402–03, 404–05	Rural	0.798	0.639	<0.0001	2.882	46.469
	416–434						
Suicide	163–64	Urban	0.037	0.001	0.2393	0.026	16.233
		Rural	0.329	0.332	<0.0001	0.167	8.201
Motor vehicle	470	Urban	0.234	0.018	0.0408	0.171	16.232
Accidents		Rural	0.451	0.203	0.0001	0.695	12.230

[a] International classification of disease 1938 revision.
[b] Age adjusted death rate each strata.

Evaluation of the hypothesis

To evaluate the hypothesis, I examined mortality in US populations with and without residential electrification. Vital statistics tabulations of deaths [6], US census records for 1920–1940 [7], and historical US documents [8,9] were examined in hard copy or downloaded from the internet. The same state residential electrification data used in the childhood leukemia study [1] was used in this study. Crude death rates were calculated by dividing number of deaths by population at risk, and death rates by state were then correlated with electrification rates by state using downloaded software [10]. Time trends of death rates for selected causes of death by state were examined. Most rates were calculated by state for urban and rural residence for whites only in 1940 deaths, since complete racial data was available by urban/rural residence by state for only 13 of 48 states. Data was available for 48 states in the 1940 mortality tabulations. District of Columbia was excluded because it was primarily an urban population. Excel graphing software [11] and "Create a Graph" [12] software was used.

I had hoped to further test the hypothesis by studying mortality in individual US farms with and without electrification, when the 1910 US census 70 year quarantine expired in 2000. Unfortunately, the 1930 US farm census schedules had been destroyed.

Findings

Rural residential electrification did not reach urban levels until 1956 (Table 1). Table 2 shows the level of residential electrification for each state for 1930 and 1940. In 1930 and 1940 only 8.33 and 33%, respectively, of all generated electricity was used in residences. Most electricity was used in commercial and industrial applications.

Figs. 1–4 were copied and scanned from "Vital statistics rates in the United States 1940–1960", by Robert Grove Ph.D. and Alice M. Hetzel. This volume was published in 1968. Fig. 1 shows a gradual decline in the all cancer death rate from 1900 to 1960 except for a spike caused by the 1918 influenza pandemic. Death rates due to tuberculosis, typhoid fever, diphtheria, dysentery, influenza and pneumonia and measles all fell sharply in this period, and account for most of the decline in the all causes death rate. Figs. 3–4 show that in the same time period when the all causes death rate was declining, all malignant neoplasms (Fig. 2), cardiovascular diseases (Fig. 3), and diabetes (Fig. 4) all had gradually increasing death rates. In 1900, heart disease and cancer were 4th and 8th in a list of 10 leading causes of death. By 1940 heart disease had risen to first and cancer to second place, and have maintained that position ever since. Table 3 shows that for all major causes of death examined, except motor vehicle accidents, there was a sizable urban excess in 1940 deaths. The authors of the extensive 09 page introduction to the 1940 mortality statistics volume noted that the cancer rates for cities were 58.2% higher than those for rural areas. They speculated that some of this excess might have been due to rural residents dying in urban hospitals. In 1940, deaths by place of residence and occurrence are presented in separate volumes. In 1940 only 2.1% of all deaths occurred to residents of one state dying in another state. Most non-resident deaths were residents of other areas of the same state. Table 4 presents correlation coefficients for the relationship between death rates by urban rural areas of each state and the percent of residences in each state with electric service. In 1940 urban and rural residence information was not available for individual cancers as it was in 1930, but death rates for each cancer were available by state. They were used to calculate correlations between electric service by state and respiratory cancer, breast cancer and leukemia mortality.

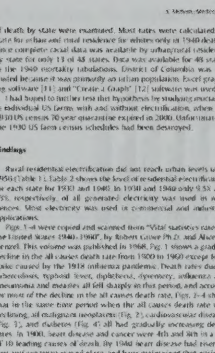

Fig. 1. Death rates, death registration states, 1900–32, and United States, 1933–60.

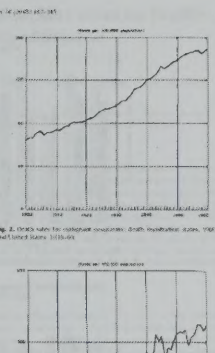

Fig. 2. Death rates for malignant neoplasms, death registration states, 1900–32, and United States, 1933–60.

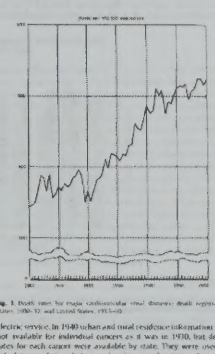

Fig. 3. Death rates for major cardiovascular renal diseases, death registration states, 1930–32 and United States, 1933–60.

All causes of death

There was no correlation between residential electrification and total death rate for urban areas, but there was a significant correlation for rural areas ($r = 0.639$, $p = <0.0001$). Fig. 5 shows the 1940 resident white death rates for urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. In the highly electrified states, urban and rural death rates were similar, but in low electrification states, the urban death rates were systematically higher than the rural death rates. The urban death rates were similar in both high and low electrification states.

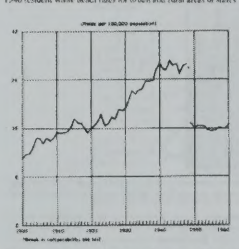

Fig. 4. Death rates for diabetes mellitus, death registration states, 1900–32, and United States, 1933–60.

All malignant neoplasms

In 1940, the urban total cancer rate was 40.2% higher than the rural rate. Both urban and rural cancer deaths rates were significantly correlated with residential electrification. Fig. 6 shows the 1940 resident white total cancer rates by urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. Four of the five high electrification states had similar urban and rural total cancer rates, while all the low electrification states had urban rates about twice as high as rural rates. Both urban and rural total cancer rates were lower in low electrification states than in high electrification states. Fig. 7 shows the time trend of the total cancer rate between 1920 and 1960 for Massachusetts (1940 electrification rate = 97.9%) and Louisiana (1940 electrification rate = 49.9%). The Massachusetts cancer rate was about twice that of Louisiana between 1920 and 1945. The Massachusetts rate leveled off in 1945, but the Louisiana rate increased steadily between 1920 and 1960. A declining urban–rural gradient for cancer is still evident in 1980–1990 US cancer incidence data [13]. Swedish investigators [14] have reported increasing cancer mortality and incidence time trend breaks in the latter half of the 20th century.

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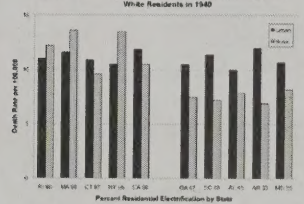

Fig. 5. All causes death rates by urban rural status and electrification in the US for white residents in 1940.

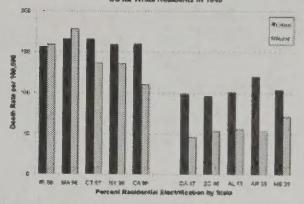

Fig. 6. Total cancer death rates by urban rural status and electrification in the US for white residents in 1940.

Respiratory cancer

No urban rural information was available for respiratory cancer, but the correlation between residential electrification and state death rates was $r = 0.611$; $p < 0.0001$. This cancer is etiologically strongly related to cigarette smoking, so the correlation with electrification is surprising. A large electrical utility worker cohort study found a high respiratory cancer incidence related to high frequency EMF transient exposure independent of cigarette smoking with a significant dose–response relationship [15].

Breast cancer

Although urban/rural information was not available for breast cancer, the 1940 state breast cancer death rates have a correlation of $r = 0.794$; $p < 0.0001$ with residential electrification. Fig. 8 shows the typical time trend of breast cancer death rates for a state with a high level of electrification (1935) and one with a low level of electrification (<50) in 1940. The California breast cancer death rate increased from 1920 to 1940, and then gradually decreased until 1960. The Tennessee breast cancer death rate is less than half of the California rate in 1920 and continues a steady increase until 1980.

Diabetes

This cause has a 60% urban excess. In spite of this, the correlation coefficients for urban and rural areas are similar at $r = 0.56$; $p = <0.0001$. There is some animal and human evidence that EMFs can effect insulin production and blood glucose levels [16]. Fig. 9 shows that in states with low levels of electrification in 1940, the urban diabetes death rates are consistently higher than the rural rates, but are always lower than the urban and rural rates in the high electrification states.

Leukemia

Since the childhood leukemia age peak is strongly associated with residential electrification, it was interesting that the all leukemia death rate correlation was $r = 0.375$; $p = 0.0042$. Most of these deaths are in adults and are of different types of leukemia. A study of amateur radio operators showed a selective excess only of acute myelogenous leukemia [17].

Coronary artery disease and other heart disease

These two cause groups had the same percentage urban excess (33%), and very similar patterns of urban and rural correlation coefficients with residential electrification. The urban correlations were about $r = 0.4$ and rural deaths had correlations of 0.28 and 0.29, respectively. Fig. 10 shows the 1940 resident white coronary artery disease death rates for urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. Four of the five high electrification states had similar urban and rural total cancer rates, while all the low electrification states had urban rates about twice as high as rural rates. Urban and rural coronary artery death rates were lower in low electrification states than in high electrification states.

Suicide

The urban suicide death rate is about 50% higher than the rural rate. The urban suicide rate is not correlated with residential electrification ($r = 0.077$; $p = 0.299$), but the rural death rate is correlated with 1940 state residential electrification levels ($r = 0.729$; $p = <0.0001$). Fig. 11 shows the 1940 resident white suicide for

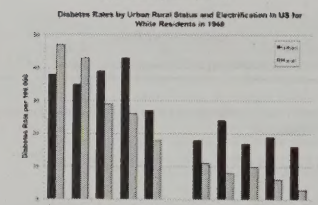

Fig. 9. Total diabetes rates by urban rural status and electrification in the US for white residents in 1940.

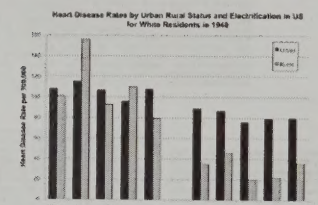

Fig. 10. Total heart disease rates by urban rural status and electrification in the US for white residents in 1940.

urban and rural areas of states having greater than 90% of residences electrified and states having less than 50% of residences electrified. In four of five high electrification states, rural suicide rates are higher than the urban rates. In all of the low electrification states, the urban rate is higher. The rural rates in the high electrification states are higher than the rural rates in the low electrification states. Fig. 12 shows X Y scatter plots for urban and rural suicide by electrification for 48 states. Suicide has been associated with both residential [18] and occupational [19] EMF exposure. Suicide is probably the visible peak of the clinical depression iceberg.

Motor vehicle accidents

Although the mortality rates are similar in urban and rural areas, the correlations with residential electrification levels are different. There is a slight negative correlation ($r = -0.254$) in urban areas and a positive correlation ($r = 0.451$) in rural areas. Since motor vehicle fatality is related to access to a vehicle and to speed, it may be that in the larger cities it was difficult to go fast enough for a fatal accident, and in rural areas especially on farms, a farmer who could afford electrification could also afford a car.

Discussion

When Edison and Tesla opened the Pandora's box of electrification in the 1880s, the US vital registration system was primitive at best, and infectious disease death rates were falling rapidly. City residents had higher mortality rates and shorter life expectancy than rural residents [9]. Rural white males in 1900 had an expectation of life at birth of over 10 years longer than urban residents.

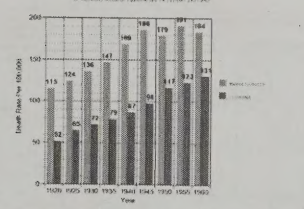

Fig. 7. US white resident total female death rates for Massachusetts (97.6% white), and Louisiana (66.4% white), by year.

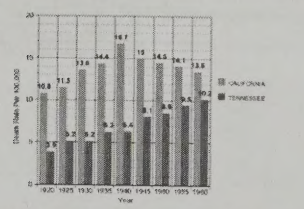

Fig. 8. US white resident breast cancer death rates for California (98.5% white) and Tennessee (78% white), by year.

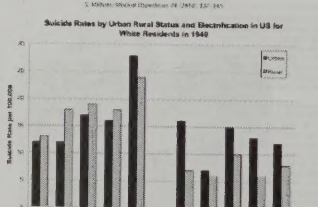

Fig. 11. Total suicide death rates by urban rural status and electrification in the US for white residents in 1940.

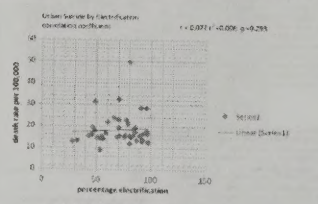

Fig. 12. 1940 US white resident urban rural suicide death rates by state and electrification.

Author's personal copy

Although the authors of the 1930 US vital statistics report noted a 58.2% cancer mortality excess in urban areas, it caused no red flags. The census bureau's residential electrification data was obviously not linked to the mortality data fundamentalists in that era were still concerned with the communicables.

Court-Brown and Doll reported [20] the appearance of the childhood leukemia age peak in 1961, forty years after the US vital statistics mortality data on which it was based was available. I reported a cluster of childhood leukemia [21] a decade after it occurred, only because I looked for it. Real time or periodic analysis of national or regional vital statistics data is still only rarely done in the US.

The real surprise in this data set is that cardiovascular disease, diabetes and suicide, as well as cancer seem to be strongly related to level of residential electrification. A community-based epidemiologic study of urban–rural differences in coronary heart disease and its risk factors was carried out in the mid 1980's in New Delhi, India and in a rural area 50 km away [22]. The prevalence of coronary heart disease was three times higher in the urban residents, despite the fact that the rural residents smoked more and had higher total caloric and saturated fat intakes. Most cardiovascular disease risk factors were two to three times more common in the urban residents. Rural electrification proceeds at a still lagging current in parts of the rural area which was studied.

It seems unbelievable that mortality differences of this magnitude could go unexplained for over 70 years after they were first reported and 40 years after they were noticed. I think that in the early part of the 20th century nobody was looking for answers. By the time EMF epidemiology got started in 1979 the entire population was exposed to EMFs. Cohort studies were therefore using EMF-exposed population statistics to compute expected values, and case-control studies were comparing more exposed cases to less exposed controls. The mortality from lung cancer in two pack a day smokers is over 20 times that of non-smokers but only three times that of one pack a day smokers. After 1956, the EMF equivalent of a non-smoker ceased to exist in the US. An exception to this is the Amish who live without electricity, like rural US residents in the 1940s. Amish males in the 1970s had very low cancer and cardiovascular disease mortality rates [23].

If this hypothesis and findings outlined here are even partially true, the explosive recent increase in radiofrequency radiation and high frequency voltage transients sources, especially in urban areas from cell phones and towers, wireless antennas, wi-fi and wi-max systems, broadband internet over power lines, and personal electronic equipment, suggests that like the 20th century EMF epidemic, we may already have a 21st century epidemic of morbidity and mortality underway caused by electromagnetic fields. The good news is that many of these diseases may be preventable by environmental manipulation, if society chooses to.

Conflicts of interest statement

None declared.

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Evaluating the impact of wind turbine noise on health-related quality of life

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Abstract

We report a cross-sectional study comparing the health-related quality of life (HRQOL) of individuals residing in the proximity of a wind farm to those residing in a demographically matched area sufficiently displaced from wind turbines. The study employed a nonequivalent comparison group posttest-only design. Self-administered questionnaires, which included the brief version of the World Health Organization quality of life scale, were delivered to residents in two adjacent areas in semirural New Zealand. Participants were also asked to identify annoying noises, indicate their degree of noise sensitivity, and rate amenity. Statistically significant differences were noted in some HRQOL domain scores, with residents living within 2 km of a turbine installation reporting lower overall quality of life, physical quality of life, and environmental quality of life. Those exposed to turbine noise also reported significantly lower sleep quality, and rated their environment as less restful. Our data suggest that wind farm noise can negatively impact facets of HRQOL.

Keywords: Amenity, annoyance, health related quality of life, sleep quality, wind turbine noise

Introduction

Wind turbines transform wind energy into electricity, a practice dating back over 100 years. However, in the last decade industrial-scale harvesting of wind energy has increased, driven by a desire to generate sustainable energy and to lessen the impact of fossil fuel depletion. Whether located in isolation or as components of a "wind farm", wind turbines were initially welcomed by many communities due to their environmental credentials, though reference to the mainstream media shows that public opposition to wind turbines has increased substantially in the past few years.[1] Complaints against established wind farms, or concern elicited by proposed wind farms, focus on the noise they produce, or the visual impact they have on the environment.

The desire to maximize electricity production while minimizing transmission costs means that in many countries wind farms have been constructed in semirural areas (also known as "greenbelt" or "lifestyle" areas) close to major towns and cities. Noise from wind farms located in semirural areas is of interest because it is typically a low amplitude noise impeding on a well-characterized and generally cherished soundscape. Consequently, there has been considerable debate over whether wind farm noise poses a significant health threat to those living in their vicinity. It has been suggested that wind turbines can directly impact health via the emission of low-frequency sound energy (i.e., infrasound below 20 Hz), though this is currently an area of controversy.[2,3] Additionally, wind turbines may compromise health by producing sound that is annoying and/or can disturb sleep. In this respect, it can be classified as community noise along side industrial or transportation noise. When built in semirural settings, the visual impact of wind farms can also degrade amenity and interact with wind turbine noise to exacerbate annoyance reactions,[4] possibly due to a violation of the landscape–soundscape continuum constructed by those who choose to live in these areas.[5]

Figure 1 represents a simple model informed by the literature[6–8] demonstrating that, in the semirural context, there are feasible mechanisms by which wind turbine exposure can degrade health and well-being. Turbine noise can lead directly to annoyance and sleep disturbance (primary health effects), or can induce annoyance by degrading amenity. Additionally, the trait of noise sensitivity, which describes individuals who are more likely to pay attention to sound, evaluate sound negatively, and have stronger emotional reactions to noise,[9] constitutes a major risk factor. The secondary health effects would be immediate reductions in general well-being, with stress-related disease emerging from chronic annoyance and sleep disturbance. Irrespective of source, chronic noise exposure is a psychosocial stressor that can induce maladaptive psychological responses and negatively impact health via interactions between the autonomic nervous system, the neuroendocrine system, and the immune system.[10] A chronic stress response will, in turn, degrade quality of life [Figure 1].

Quantifying the impact of wind turbines on individual health will inform wind turbine operational guidelines, and in this respect constitutes an important process that is currently not far advanced. A variety of outcome measures have been proposed to assess the impacts of community noise, including annoyance, sleep disturbance, cardiovascular disease, and cortisol levels.[11] An alternative approach to health assessment involves the subjective appraisal of health-related quality of life (HRQOL), a concept that measures general well-being and well-being in the physical, psychological, and social domains. Because changes in HRQOL are expected to closely co-vary with changes in health, the WHO recommends the use of HRQOL measures as an outcome variable, arguing that the effects of noise are strongest for those outcomes classified under HRQOL rather than illness.[12] HRQOL is related to health by the WHO (1948) definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity," and can be considered as an operationalization of the well-being concept.[13]

There is scientific evidence linking community noise to health problems.[14,15] The WHO reports that chronic noise-induced annoyance and sleep disturbance can compromise health and HRQOL.[16,17] However, there has been little research examining the relationship between noise and HRQOL. An exception is Dratva *et al.*,[18] who, using the Short Form (SF36) health survey, reported an inverse relationship between annoyance from traffic noise and HRQOL. They argued that HRQOL would be expected to co-vary more with annoyance than with noise level as level is generally a poor predictor of the human response to noise, and its role in health is commonly overemphasized. As alternatives to noise level, other factors associated with the listener should be considered,[19] including the perceived control a person has over the noise, as well as their attitudes, personality, and age (all of which could be added to Figure 1 as moderators).

This exploratory study examines the association between HRQOL and proximity to an industrial wind farm in a semirural area, adding to the small number of peer-reviewed studies into the health impacts of wind turbines that are only beginning to appear in the literature. Case studies supported by qualitative analyses[20–22] suggest a negative relationship between wind turbine noise and well-being. There have been no previous quantitative investigations of the impact of wind farms on HRQOL, though correlations have been observed between wind turbine noise, annoyance, and sleep disruption.[20,23] Given these findings, and with reference to Figure 1, it would be expected that both mean amenity and sleep satisfaction scores would be lower in individuals residing around turbines, and that the proportion of individuals annoyed by noise would be greater for those exposed to turbines than those not. Additionally, lowered amenity and greater annoyance should result in lower mean HRQOL domains in those residing close to wind turbines.

Materials and Methods

Design

A nonequivalent comparison group posttest-only study

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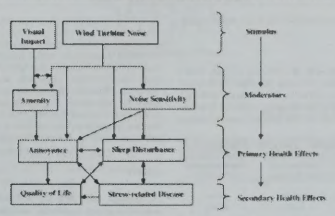

Figure 1: A schematic representation of the relationship between wind turbines and health in a semirural setting. The multiplicity of relationships emerges due to variability in the response of individuals to noise

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design was utilized. Strict socioeconomic matching was undertaken using the New Zealand Deprivation Index 2006,[10] as described elsewhere.[10] Both areas are classified as *semirural*,[10] with a population density of less than 15 people per square kilometer.

Sample

Samples were drawn from two demographically matched areas differing only in their distances from a wind farm in the Makara Valley, a coastal area 10 km west of New Zealand's capital city, Wellington. The Makara Valley is characterized by hilly terrain, with long ridges running 250-450 m above sea level, on which 66 125 m high wind turbines are positioned as part of the "West Winds" project. Figure 2 is a map showing the positions of a subset of wind turbines relative to some of the houses in valley. The first sample (the *Turbine* group) was drawn from residents in the South Makara Valley who resided in 56 houses located within 2 km of a wind turbine. A comprehensive noise survey of the area was undertaken independently, indicating intrusive elements of the turbine noise such as the "rumble-thump."[10] The Makara turbines, operational since May 2009, have measured levels that are consistent with levels reported in European studies,[2,3] in which typical noise exposures from wind turbines ranged from between 24 dB(A) and 54 dB(A). Long-term measurements undertaken by the wind farm developers at various residences show that while average outdoor levels ($L_{A90,10\ mins}$) dB(A)) are largely compliant with consent conditions, they still range between 20 dB(A) and 50 dB(A) depending on meteorological conditions.[10] The second sample (the *Comparison* group) was taken from residents in 250 houses in a geographically and socioeconomically matched area, but which were located at least 8 km from any wind farm in the region.

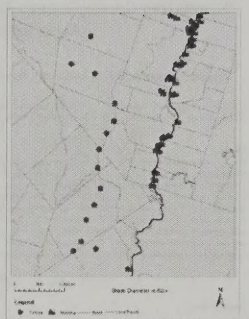

Figure 2. Map showing a part of the Makara Valley and the relative distances between houses and 14 of the 66 turbines. The 9 tiel turbines (Nacelles NTT-2.3-82 USs) have 68 m high towers and rotor diameters of 82 m (Map generated by Rachel Summers, and displayed with permission).

Questionnaire

The coversheet of the questionnaire bore the title *2010 Well-being and Neighbourhood Survey*, designed to mask the true intent of the study. Each house received two copies of the questionnaire. Potential participants were invited to participate in the research investigating their place of living and their well-being if they resided at the address to which the questionnaire had been delivered and if they were 16 years or older. The order of the questions was a prime consideration: HRQOL (26 items), amenity (2 items), neighborhood problems (14 items), annoyance (7 items), demographic information (7 items), and a single item probing noise sensitivity. All scale items were presented on a numbered five-point scale with appropriate descriptors anchoring the terminals. Self-reported HRQOL was measured using the abbreviated version of the WHOQOL-BREF which affords composite measures of physical (7 items), psychological (6 items), and social (3 items) HRQOL. Additionally, the WHOQOL-BREF has two generic items asking about general health and overall quality of life, and an additional domain measuring environmental QOL (8 items). The two amenity items were: "I am satisfied with my neighbourhood/living environment" and "My neighbourhood/living environment makes it difficult for me to relax at home." A modified neighbourhood problem scale[10] consisted of 14 distractor items that were not relevant to the current study and were not included in the analysis. Seven items on annoyance were included, four distractor items asking about air quality, and three items probing annoyance to traffic, other neighbours, or other noise (*ipsative specific*). Additionally, participants were asked if they were not noise sensitive, moderately noise sensitive, or very noise sensitive. The questionnaire terminated with an open-ended item asking "If you would like to share any comments relating to your neighbourhood or this survey then please do so in the box below." Participants were asked to respond to all items and to return surveys by post in the prepaid envelopes provided.

Demographics

Self-reported age and sex measures were obtained and self-reported level of educational status used as a further indicator of socioeconomic status. Additionally, participants were asked what their current employment status was, and whether they were currently ill or had a medical condition.

Participants were also asked how long they had lived at their current residence.

Statistical analysis

Analysis commenced after an evaluation of each scale's psychometric properties, including inspection for floor and ceiling effects and tests of internal consistency (Cronbach's alphas) and to validate dimensionality (corrected item-total correlations). Differences in HRQOL and amenity between the turbine and comparison groups were calculated using univariate analysis of covariance (ANCOVA), with length of residence selected *a priori* as a covariate. All testing was undertaken in accordance with Tabachnick and Fidell's[11] guidelines for testing between groups with unequal sample sizes, and Bonferroni corrections were applied where appropriate. Because of the unequal sizes between the two groups, the assumptions of normality and homogeneity of variance were assessed carefully. Five cases were excluded from the comparison group because they were multivariate outliers as defined by extreme Mahalanobis distances, with response set acquiescence clearly evident in all five cases.

Table 1: Demographic profile of the turbine and comparison groups

Variables	Turbine group (n=39) n (%)	Comparison group (n=150) n (%)
Sex		
Male	16 (41)	83 (55)
Female	23 (59)	67 (45)
Age group, years		
15-20	3 (7.6)	2 (1.2)
21-30	3 (7.6)	1 (0.5)
31-40	5 (12.8)	22 (14.9)
41-50	10 (25.6)	53 (35.8)
51-60	11 (28.2)	44 (29.8)
61-70	7 (17.9)	23 (15.6)
71+	1 (2.5)	3 (2.0)
Education (completed)		
High school	11 (28.2)	58 (38.8)
Polytechnic	11 (28.2)	46 (30.5)
University	17 (43.6)	46 (30.5)
Employment status		
Full time	21 (53.8)	83 (55.3)
Part time	9 (23)	5 (3.3)
Unpaid work	3 (7.6)	3 (2.0)
Unemployed	4 (10.3)	27 (17.9)
Retired	10 (25.6)	39 (25.3)
Noise sensitivity		
None	13 (33.3)	60 (39.9)
Moderate	23 (58.9)	76 (50.3)
Severe	3 (12.8)	20 (13.2)
Current illness		
Yes	10 (25)	50 (33.6)
No	27 (68.2)	100 (66.8)

Totals may differ due to missing data.

Table 2: Pearson product-moment correlation coefficients (r) for noise-related and HRQOL variables. Statistics to the right of the major diagonal are for the comparison group, while those to the left are for the turbine group

	Sensitivity	Annoyance	Sleep	Health	Health-related quality of life				
					Physical	Psychological	Social	Environmental	Overall
Sensitivity	1	0.134	0.083	0.042	−0.017	−0.009	0.008	−0.066	−0.109
Annoyance	0.440**	1	0.602	0.258**	0.208*	−0.135	−0.155*	−0.319**	−0.097
Sleep	0.431**	0.147	1	0.137**	0.139**	0.460**	0.127**	0.239**	0.195*
Health	−0.234	−0.308	0.473**	1	0.706**	0.492**	0.358*	0.284**	0.527**
Physical	−0.24	−0.222	0.364*	0.528**	1	0.655**	0.259*	0.455**	0.475**
Psychological	−0.404*	−0.113	0.475**	0.329*	0.368	1	0.595**	0.666**	0.509**
Social	−0.530*	−0.256	0.136	−0.021	0.036	0.215	1	0.456**	0.445**
Environment	−0.235	0.029	0.466**	0.2	0.474*	0.468*	−0.17	1	0.546**
Overall	−0.203	0.16	0.474**	0.289	0.282	0.298	0.162	0.389*	1

*P < 0.05, **P < 0.001. Note: If variables in the shaded area were removed from the PCA of HRQOL domains, all six correlated well with single satisfaction.*

Table 3: Mean (M) and standard deviation (SD) statistics for the four HRQOL domains of the WHOQOL-BREF and amenity total scores, presented for both the comparison group and the turbine group

Measure	Turbine group		Comparison Group	
	M	*SD*	*M*	*SD*
Physical	27.38	3.14	29.14	3.59
Psychological	22.36	2.62	23.29	2.91
Social	12.51	1.95	12.54	2.13
Environmental	29.92	3.76	32.56	4.41
Amenity	7.46	1.42	8.91	2.64

Results

The response rates, 34% and 32% from the turbine and comparison groups, respectively, are typical for this type of research (e.g., van den Berg and colleagues[12] report a 37% response rate). Table 1 presents demographic information for the comparison and turbine groups. Prior to analyses the data were screened to identify potential confounds. The proportions of males and females in each area were equivalent ($\chi^2(1) = 0.001$, $P = 0.967$), while a Mann–Whitney U indicated no age difference between the two areas ($U_{Mann-Whitney} = 158$, $z_{adj} = -3.91 = 16022.5$, $P = 0.802$). Education ($\chi^2(2) = 2.474$, $P = 0.291$), noise sensitivity ($\chi^2(2) = 0.553$, $P = 0.7581$, and self-reported illness ($\chi^2(1) = 0.414$, $P = 0.562$) were not associated with area.

Table 2 displays correlation coefficients (Pearson's *r*) between noise-related and health-related variables for both groups. Of remark is the negative correlation between annoyance and self-rated health for both groups, and a different pattern of correlations between noise sensitivity and annoyance across the two groups. Separate ANCOVA's revealed differences and similarities between the two areas in terms of HRQOL (Table 3). Firstly, the turbine group reported lower ($F(1,194) = 5.816$, $P = 0.0171$) mean physical HRQOL domain score than the comparison group. Scrutiny of the seven facets of the physical domain showed a difference in perceived sleep quality between the two areas ($t(195) = 3.089$, $P = 0.006$), and between self-reported energy levels ($t(195) = 2.217$, $P = 0.028$). Secondly, the turbine group had lower ($F(1,194) = 5.694$, $P = 0.018$) environmental QOL scores than the comparison group. This domain is the sum of eight items, and further analysis of these revealed that the turbine group considered their environment to be less healthy ($t(195) = 5.272$, $P < 0.007$) and were less satisfied with the conditions of their living space ($t(195) = 2.176$, $P = 0.031$). Thirdly, there were no statistical differences in social ($F(1,194) = 0.002$, $P = 0.963$) or psychological ($F(1,194) = 3.334$, $P = 0.069$) HRQOL, although the latter was marginal and the mean for the turbine group was lower. Of the two generic WHOQOL-BREF items, the mean of the self-rated general health item was equivalent between turbine and comparison groups ($t(195) = 0.374$, $P = 0.709$), while the mean ratings for an overall quality of life item was lower ($t(195) = 2.364$, $P = 0.019$) in the turbine group.

The turbine group reported lower amenity than the comparison group ($F(1,194) = 15.88$, $P < 0.001$). There were no differences between groups for traffic ($t(195) = 0.568$, $P = 0.154$) or neighborhood ($t(195) = 1.458$, $P = 0.144$) noise annoyance. A comparison between ratings of turbine noise was not possible, but the mean annoyance rating for turbine group individuals who specifically identified wind turbine noise as annoying (n=23) was 4.59 (SD = 0.65), indicating that the turbine noise was perceived as extremely annoying. For the comparison group, seven "other" annoying noises were identified: barking dogs (x2), farm machinery (x2), and roaring cars (x3).

Discussion

Our results link exposure to wind turbines to degraded HRQOL, a finding that is consistent with the model described in Figure 1. Specifically, those residing in the immediate vicinity of a wind farm scored worse than a matched comparison group in terms of physical HRQOL and environmental QOL, and HRQOL in general. No differences were found in terms of psychological and social HRQOL, or in self-rated health. The high incidence of annoyance from turbine noise in the turbine group is consistent with the theory that exposure to wind turbine noise is the cause of these differences. Importantly, we also found a reduction in sleep satisfaction ratings, suggesting that both annoyance and sleep disruption may mediate the relationship between noise and HRQOL. These findings are consistent with those reported in relation to aviation noise[13] and traffic noise.[13,14]

Of further interest are the likely mechanisms involved in the degradation of HRQOL when exposed to turbine noise. Studies show that the level of turbine noise as a poor predictor of human response, and dose-response relationships typically explain little of the association between turbine noise and annoyance.[2,3] Pedersen *et al.*[4,15] and van den Berg *et al.*[12] show that, for equivalent noise levels, people judge wind turbine noise to be of greater annoyance than aircraft, road traffic, or railway noise. This may be due to the unique characteristics of turbine noise, that is, clusters of turbines present a cumulative effect characterized by a dynamic or modulating sound as turbines synchronise. The characteristic swishing or thumping noise associated with larger turbines[16] is audible over long distances, up to 5 km and beyond in some reports.[10]

van den Berg[12] showed that sound is the most annoying aspect of wind turbines, and is more of a problem at night. A large proportion (23.3%) of respondents from the turbine group identified turbine noise as a problem and rated it to be extremely annoying. It should be noted that, in contemporary medicine, annoyance exists as a precise technical term describing a mental state characterized by distress and aversion, which if maintained, can lead to a deterioration of health and well-being.[17] A Swedish study[18] reported that, for respondents who were annoyed by wind turbine noise, feelings of resignation, violation, strain, and fatigue were statistically greater than for respondents not annoyed by turbine noise. An attempt at constructing dose-response relationships between turbine noise level and annoyance in a European sample suggests that at calculated noise levels of 30-35 dB(A), 10% of the sample was either or very annoyed at wind turbine sound, increasing to 20% at 35-40 dB(A) and 25% at 40-43 dB(A).[19]

We also observed lower sleep satisfaction in the turbine group than in the comparison group, a finding which is consistent with previous research.[20,21] One study directly related to wind turbine noise reported that 16% of respondents experiencing 35 dB(A) or more of noise suffered sleep disturbances due to turbine noise.[22] Another study investigating the effects of wind turbine noise on sleep showed that 36% of respondents who were annoyed at wind turbine noise also reported that they suffered disturbed sleep (versus 9% of those not annoyed).[10] A case-study approach examining exposure to turbine noise likewise identified turbine noise as an agent of sleep disturbance.[23] In relation to turbine noise levels, one study reported that even at the lowest noise levels (<25 dB(A)), 20% of respondents reported disturbed sleep at least one night per month,[21] and that interrupted sleep and difficulty in returning to sleep increased with calculated noise

level. Demonstrably, our data have also captured the effects of wind turbine noise on sleep, reinforcing previous studies suggesting that the acoustic characteristics of turbine noise are well suited to disturb the sleep of exposed individuals.

While strong correlations exist between the sound level and the perceived loudness of a sound, there is no clear relationship between level and the psychological responses that individuals have to a sound. Noise sensitivity is one psychological factor that is increasingly being related to noise annoyance in literature.[24] We found that, for the turbine group, noise sensitivity is a strong predictor of noise annoyance and is correlated with facets of HRQOL, supporting other studies suggesting that annoyance mediates the relationship between noise sensitivity and HRQOL.[25] Other studies show that noise sensitivity has a large impact on noise annoyance ratings, lowering annoyance thresholds by up to 10 dB.[26] The lack of statistical significance in the comparison group may indicate that, in the absence of annoying noise, the impact of noise sensitivity on HRQOL may be underestimated.

Another finding emerging from our data is that living close to wind turbines is associated with degraded amenity. This is consistent with previous research showing that wind turbine noise was judged incongruent with the natural soundscape of the area.[27] Amenity values are based upon what people feel about an area, its pleasantness, or some other value that makes it a desirable place to live. There is an expectation of "peace and quiet" when living in a rural area, and most choose to live in rural areas for this reason.[27] Furthermore, those who live in rural areas have different expectations about community noise that those living elsewhere.[4] Other studies[28,29] report that wind turbines are viewed as eyesores and visual spoilers of the environment, and from an aesthetic perspective, those who view the wind turbines as ugly are likely to dissociate them from the landscape and react more strongly to turbine noise. The measurement of the perceived visual impact of the wind farm was beyond the scope of the current study, specifically due to the masking of the study's intent. Scrutiny of the comments provided by the turbine group, however, revealed no mention of the impact of turbines on the landscape, reinforcing suggestions made by others,[27] that wind farm noise is more dominant than their visual aspects.

Strengths and limitations

A strength of this study is the masking of the primary intent of the questionnaire by giving the impression that general neighborhood factors (e.g., street lighting, rubbish collection), and not wind turbine exposure, constituted the study's core aims. Concealing the study's objectives should reduce response bias, and our placing of the HRQOL items at the beginning of the survey, well before the three items probing noise annoyance, would serve to elicit subjective ratings of HRQOL without first being primed with potentially upsetting noise items. A further strength is the use of a nationally validated inventory that adopts a multidimensional approach to HRQOL.

The main limitation of the study, partly forced by our desire to conceal the aim of the survey, was that coincident noise measurements were not obtained. While independent estimates of wind farm noise in the Makara Valley have been reported,[10,22] it would have been desirable as undertake measurements in both the turbine and the control areas. That said, on the basis of the very few noise complaints made by those in the control areas (as described in the Results section), we are confident that the control areas provide typical semirural soundscapes that are not encroached by intrusive noise. An additional limitation of the study is the sample size of the turbine group. While the response rate compares favorably to other wind turbine research reported in the literature,[2,3] the sparsely populated locales surrounding wind farms in rural New Zealand presents a recruitment challenge. A larger sample of residences exposed to wind turbines would have afforded more statistical options. However, that the effects were found with such a modest sample size may be indicative of genuine differences between the two groups.

Any future adoption of the model presented in Figure 1 should increase the number of moderators, and include factors such as attitudes to the noise source and individual coping strategies. For example, the conflict between the Makara community and the wind farm developers could also potentially reduce HRQOL or amplify annoyance reactions and sleep difficulties. A telephone complaints line, set up by the wind farm developer as a condition of consent, attracted over 1000 noise complaints in the first year. Such conflict would induce stress and emotional reactions that would be expected to degrade psychological HRQOL, though this was not found to be different from the control group. An explanation of this null result on the psychological domain may be derived from the open-ended comments from the control group, which reveal that they themselves are in conflict with local government bodies attempting to increase residential dwellings in the area.

Conclusion

A thorough investigation of wind turbine noise and its effects on health is important given the prevalence of exposed individuals, a nontrivial number that is increasing with the popularity of wind energy.[30] For example, in the Netherlands it is reported that 140,000 inhabitants (2.5% of the population) are exposed to significant levels of wind turbine noise.[22] Additionally, policy makers are demanding more information on the possible link between wind turbines and health in order to inform setback distances. Our results suggest that utility-scale wind energy generation is not without adverse health impacts on nearby residents. Thus, nations

undertaking large-scale deployment of wind turbines need to consider the impact of noise on the HRQOL of exposed individuals. Along with others,[6,9] we conclude that night-time wind turbine noise limits should be set conservatively to minimize harm, and, on the basis of our data, suggest that setback distances need to be greater than 2 km in hilly terrain.

Acknowledgments

We are grateful to our colleagues and others whose reviews substantially improved the manuscript. We are especially grateful for the thorough review undertaken by Professor Rex Billington, also as the WHO Director of Mental Health in the 1990s overseas the development of the WHO's program into quality of life, health and the environment.

Address for correspondence:
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School of Public Health, Auckland University of Technology, Private Bag 92006, Auckland 1142, New Zealand.
E-mail: daniel.shepherd@aut.ac.nz

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Source of Support: Nil. **Conflict of Interest:** None declared.

cc: Margaret Goodro, BLM El Centro
Tribal Leaders
Interested Parties
Intertribal Cultural Resources Protection Council

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Raymond "Bear" Cuero, Councilman

September 27, 2011

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BUREAU OF LAND MANAGEMENT
2011 SEP 30 PM 12:13
cc: CENTRO FIELD OFFICE
EL CENTRO CA.

Bureau of Land Management
Attn: Mr. James Kenna, State Director
California State Office
2800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Re: Ocotillo Express

Dear Mr. Kenna:

On behalf of the Viejas Band of Kumeyaay Indians, I am writing to request your immediate review of the Ocotillo Wind Energy Facility Draft Environmental Impact Report. As you may be aware, the public comment period closes on October 6, 2011. Viejas, other Indian tribes and members of the public have very serious concerns about the adequacy of this document, about the direct, indirect and cumulative impacts of this project, and about the apparent plan to approve this project despite numerous objections and concerns. We are also concerned with the BLM's failure to engage in meaningful consultation with Indian tribes on this matter.

For the reasons stated above, we request that 1) the BLM hold public hearings on this project and allow the opportunity for public testimony on the record; and 2) the BLM extend the DEIR public comment period to November 15, 2011 or later to allow for thorough review and comment. We appreciate your consideration of our request and your timely response.

Thank you for your attention to this matter. We may be contacted at 619-659-2323 or via Kim Mettler, General Counsel at 619-659-1710 with questions or comments.

Sincerely,

Anthony R. Pico, Chairman
Viejas Band of Kumeyaay Indians

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PLANNING & DEVELOPMENT SERVICES

September 16, 2011

U.S. ARMY CORPS OF ENGINEERS,
LOS ANGELES DISTRICT, Regulatory Division
ATTN: SPL-2009-00971-MJS
6010 Hidden Valley Road, Suite 105
Carlsbad, CA 92011

Meris.Bastilan-Smith@usace.army.mil

Re: Public Notice, Ocotillo Wind Energy Facility Project

Dear Chief, Regulatory Division:

This letter is timely sent on behalf of the Viejas Band of Kumeyaay Indians, a federally-recognized tribe, in response to the general public notice of an Application for Permit from the Army Corps of Engineers for the proposed Ocotillo Wind Energy Facility Project. Viejas has serious concerns about this project, proposed within Kumeyaay ancestral territory, as recognized by California Assembly Joint Resolution 60 (August 15, 2002), oral history, and other authority.

Evaluation Factors: Tribal Concerns Detailed

As part of the Ocotillo Express LLC's Application for Permit, Viejas wanted to make your office aware of the concerns of the Tribe as described in detail in prior correspondence from Viejas. Attached, please find letters from Viejas to the Bureau of Land Management (BLM) dated August 25, 2011, and from Viejas to Department of Interior Secretary Salazar September 10, 2011.

Viejas' concerns about the project include many that also fall under the purview of the Army Corps and its evaluation factors: conservation, aesthetics, cultural values, land use, historic properties, cumulative and indirect impacts and the public interest and welfare of the people, among others. These concerns are shared by local tribal governments, tribal elders, public citizens, environmental groups and many others. Viejas is also concerned about ancestral human remains that have been identified and others that remain unidentified within and near the project footprint.

Viejas' concerns about the Public Notice's preliminary review of cultural resources include that Viejas believes the Area of Potential Effects (APE) is larger than simply the 13,200 acre public land footprint, to include sacred cultural viewsheds. Also, the referenced 1 mile buffer does not fully take into

account the viewshed, and other cultural resources of tribal concern. Finally, it should be noted that impacts to biological species, such as the Peninsula bighorn sheep that have been observed within the area, are also a type of cultural impact that requires consideration.

Need for Tribal Notification and Consultation

The Public Notice states that the Corps of Engineers is soliciting comments from Indian tribes (among others). However, to Viejas' knowledge, no specific outreach to tribes has been made by the Corps to tribes, including no outreach to make them aware of the Public Notice and no invitation to consult pursuant to Executive Order 13007, and other federal authority and guidance, despite that the proposed project would adversely affect access to and ceremonial use of Indian sacred sites and adversely affect the integrity of such sites.

Viejas respectfully requests that the Corps re-issue a Public Notice and send it to local tribes and also that it send out invitations to initiate government-to-government consultation between the Corps and local tribes at its earliest opportunity.

Request for Public Hearing

Based on the magnitude of these project impacts, and that the project requires a controversial amendment to the California Desert Conservation Area Plan from conservation to industrial uses, Viejas respectfully requests that a public hearing be held on the Application for Permit. The need for a public hearing is further supported by the fact the federal lead agency, BLM, declined to have a traditional public hearing in which speakers offer testimony in front of agency representatives and other members of the public and which testimony is recorded and transcribed. BLM's decision was controversial, covered by the media, and needs to be remedied.

Insufficiency of Draft EIR/EIS

Your office should be aware that Viejas also intends to submit detailed comments on the Draft Environmental Impact Report/Statement (DEIR/EIS) that is presently out for public review. Viejas believes that, for reasons including those set out in the attached letters, the current DEIR/EIS is insufficient for the Corps to use to take action on the required permit. Particularly, the DEIR/EIS must be amended to include the analysis and results of the ongoing cultural surveys, which were not completed when the DEIR/DEIS was released for public review.

Overall Public Interest Is High

As mentioned above, the overall public interest in the project is high, as evidenced by the media stories on the project. Moreover, the protection of Tribal sacred and cultural places is of local, state and national concern as evidenced by the area's inclusion in the California Native American Heritage Commission's Sacred Lands File and placement on the National Register of Historic Places as nationally significant (i.e., the Spoke Wheel Rock Alignment, listed on September 29, 2005, for cultural values

including its viewshed). The National Congress of American Indians has also passed resolutions making protection of such areas a priority.

Overly Restrictive Project Purpose

The overall project purpose is described as providing a wind energy facility ranging in size from 315 MW to 465 MW in Imperial County, California. Viejas is concerned that the purpose may be too restrictive thereby not allowing for a full range of offsite alternative location(s) to be considered. Offsite alternatives, including already disturbed private lands (such as agricultural) should be considered before intact, conserved, public lands are used. Also, the project could be spread across more than one location (segregating offsite locations). Finally, with such a narrowly drawn purpose, there may be qualifying locations in other counties or even in Mexico, having fewer impacts, that would be overlooked. All of these should be examined in the DEIR/EIS.

Additional Project Information

Viejas is also concerned about the number and variety of washes that would be impacted by the proposed project. The Corps must carefully examine the ecosystem effects of the project as well as the potential impacts to system reliability and maintenance.

The project's road network would induce public access which would in turn cause otherwise avoided direct impacts to sensitive tribal cultural resources. The DEIR/EIS does not contain adequate mitigation for this impact. Viejas is concerned about the width of construction roadways areas (up to 36-foot-wide). This width is further exacerbated by the stated additional 15-foot-wide underground collection systems infrastructure, bringing some road impact widths to over 50 feet. Disturbances for such roads would be incompatible with the aesthetics and the resources of this area and further encourage both legal and illegal public access.

Referenced Mitigation Vague and Inadequate

The proposed mitigation in the Public Notice is vague and inadequate. The referenced avoided areas may not be accurate given the propensity for wash outs and erosion events; the referenced impact minimization is overly general and lacks specificity of the purported benefits of the redesign; and the referenced compensatory mitigation location for wetland or non-wetland areas is not identified.

Viejas is also concerned about the lack of proposed mitigation in the Public Notice and the DEIR/EIS for tribal cultural resources.

Summary

In sum, Viejas is deeply concerned about the proposed project's impacts to tribal cultural, and other, resources. In addition to the requests above, Viejas would like to have a meeting on this project with your office. Finally, please place the Viejas Office of Legal Affairs on all project notices for this project. Should you have any questions, please do not hesitate to contact me directly.

Sincerely yours,

Kimberly R. Mettler, Director
Viejas Office of Legal Affairs

Attachments:
Viejas letter to Bureau of Land Management, August 25, 2011
Viejas letter to Department of Interior Secretary Salazar, September 9, 2011

Copies:
Margaret Goodro, BLM Field Manager
Angelina Havens, County of Imperial, Planner
Larry Myers, NAHC
Nancy Brown, Advisory Council on Historic Preservation
Tribal Leaders
Interested Parties

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Victor E. Woods, Councilman
Raymond "Rosa" Cuero, Councilman

August 25, 2011

Bureau of Land Management
Attn: Margaret Goodro, Field Manager
1661 South 4th Street
El Centro, CA 92243

Re: Renewable Energy Projects: Ocotillo Express

Dear Ms. Goodro:

On behalf of the Viejas Band of Kumeyaay Indians, I am writing to express our serious concerns about this and other proposed renewable energy projects planned for the Imperial Valley desert. Specifically, the Band is concerned about the failure of the BLM, the federal lead agency, to engage in meaningful consultation with Indian Tribes and the inadequacy of the Draft Environmental Impact Report (DEIR) that has been released for public comment.

With regard to consultation, the BLM as a lead agency has an obligation under Section 106 of the National Historic Preservation Act (and other authority) to engage Tribes in meaningful consultation. This obligation is not discharged by simply sending a letter of information or meeting with Tribes for consultation and doing no more at that meeting than requesting that tribal concerns be submitted to the BLM in a letter. Instead, the BLM should be actively engaged in outreach to affected Tribes, especially given the number of proposed projects in this area. The BLM should also be actively engaged in ongoing efforts to develop working relationships with the Tribes and finding ways in which Tribal concerns - not the concerns of archaeologists alone - can be meaningfully considered and integrated into environmental and land use planning analysis.

Furthermore, critical to meaningful consultation is timely, accurate, and adequate information. It is our understanding that—aside from Sunrise Powerlink, Tule Wind and Ocotillo Express—there are approximately 100 or more proposed projects being considered for the Imperial Valley and those projects will be interconnected with each other and Powerlink, Tule Wind and Ocotillo Express. Information provided by the BLM to the Tribes is not helpful in informing Tribes of those other projects or their project status as informational letters are spread over a long period of time and are not explicit about cumulative impacts. Additionally the notices on the numerous projects are often confused with one another because no effort has been made by the BLM to provide a comprehensive picture of what is planned for this area and for Eastern San Diego County. Further, the BLM has failed to respond to our comments in writing or otherwise, and the BLM has not provided any information to us regarding consultation meetings with other Tribes and their outcomes. This compartmentalization of consultation and information is unworkable and unacceptable.

With regard to the DEIR, its purpose is to evaluate the potential impacts of a proposed project and its alternatives. Viejas struggles to understand how such an evaluation could take place when field surveys identifying Tribal cultural resources have not been completed as of the date the DEIR was released. During the course of the Tribal cultural resources surveys, the research plan and protocol was changed without notice or consultation to the Tribes. In fact, neither Tribes nor their cultural resource monitors were consulted in the field on any aspect of the identification, value, meaning, or purpose of tribal cultural resources located in the field. No cultural landscape study or ethnography has been completed or even planned. All of these things are necessary and should be required *as a part* of the Tribal cultural resources inventory and evaluation (which should have been part of the DEIR) in order to appropriately evaluate the impacts of the proposed project and its alternatives. This information is critical to the Tribes as well, because when combined with our knowledge of this area and the insights of our Tribal cultural monitors, elders and spiritual leaders, both the BLM and the Tribes will have what is necessary to form an informed, well-considered evaluation of the project impacts and will be better situated to work together to determine whether adequate mitigation can occur.

On a related note, a number of people from California and Arizona Tribal nations have visited the area and have participated in ceremonies as they have done for a number of

years. It was brought to our attention that areas where these Tribal cultural resources—including cremations and human remains—are located are within public use areas of the Imperial Valley. The concern to us is that the public use areas are dangerously close to many of the resources and it is clear from the current disturbances of some of these resources and the garbage found near them that the BLM is not discharging its duty to properly manage and protect these resources as it is. As a result, we are concerned that the BLM would be further unable to discharge this duty if the proposed projects are approved and additional public access occurs due to the new access roads that are part of the project design.

Finally, this project requires an amendment to the California Desert Conservation Area Plan (the "Plan"). The Tribes trusted that the designations of the Plan for this area "Class L - Limited Use" would remain. This use designation is to promote and maintain open space and biological and cultural resources values. Instead, the applicant wants this decades-old Plan, upon which we as Tribal nations relied, to be changed with a stroke of a pen to allow industrial uses to occur on these open space lands. There has been inadequate public discussion about these land use amendments and the Viejas Band is strongly opposed to such amendments as it amounts to nothing more than spot zoning (a disfavored land use practice) and privatization of our sensitive public lands.

The BLM as a federal agency has a trust responsibility not to the project applicants and their proponents, but to Indian Tribes. Part of this responsibility is to engage Tribes in a meaningful and informed way, and provide them an opportunity to fully participate in the NEPA process. While it is true that in recent days it appears the nation's priority is the development of renewable energy projects, this does not negate the obligations the federal government has to Indian Tribes, which includes consultation. The number of proposed projects and the speed with which they are being analyzed and approved is alarming because the full impact of these projects - individually and collectively - is not being adequately evaluated, and therefore cannot be fully understood.

The Viejas Band requests that the application process for the Ocotillo Express project and all other proposed projects be postponed and/or altogether stopped until all interested parties, including Indian Tribes, are provided comprehensive information about the projects and have reasonable time to adequately evaluate the project impacts and provide comment. Furthermore, information should be provided to all interested

parties as to the cumulative impacts of these multiple projects on biological and cultural resources, as well as the cultural landscape and viewshed. Until this information is provided, neither Indian Tribes nor the public can participate in this process in any meaningful way.

We appreciate your continued attention to this matter. Please contact my office at 619-659-2323 or Kimberly R. Mettler at 619-1710 with any questions or comments.

Sincerely,

VIEJAS BAND OF KUMEYAAY INDIANS

Hon. Anthony R. Pico
Chairman

Cc: Intertribal Cultural Resources Protection Council
Tribal Leaders
Advisory Council for Historic Preservation
Native American Heritage Commission
California State Office of Historic Preservation
County of Imperial
California Public Utilities Commission
Bureau of Land Management, Jim Kenna, State Director

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September 9, 2011

Ken Salazar, Secretary
U.S. Department of Interior
1849 C Street, N.W.
Washington DC 20240

Re: Request for Denial of Proposed Tule Wind and Ocotillo Express Wind Projects
San Diego and Imperial Counties, California

Dear Secretary Salazar:

On behalf of the Viejas Band of Kumeyaay Indians, a federally-recognized tribe, I am writing to respectfully request that the Department of Interior deny two proposed projects on federal public lands within our Kumeyaay Ancestral Homelands: the proposed Tule Wind Project and the proposed Ocotillo Wind Express Project. Both of these projects would cause permanent, irreparable and unacceptable harms to tribal heritage resources. Viejas' letters to the federal lead agency, the Bureau of Land Management, regarding our concerns about these projects are attached. So you to see in more detail our specific concerns.

Relative to Tule Wind, the BLM has not addressed Viejas' concerns regarding tribal cultural resource survey and documentation. Viejas has also expressed serious concerns regarding lack of meaningful consultation and unacceptable and unmitigated impacts to the rural cultural landscape/viewshed and nested golden eagle populations. Moreover, given that we understand the project may require a General Plan amendment from the County of San Diego, SB 18 consultations between the County and Viejas relative to the project would be required; for the federal government to approve this project while these required consultations have neither been initiated nor completed, risks inconsistent project outcomes. Given the lack of seriousness with which the BLM has taken each of our concerns, Viejas is left with no option but to request your denial of this and its related projects.

Regarding Ocotillo Express, the BLM has not addressed Viejas concerns regarding tribal cultural resource survey and documentation. Viejas has also expressed serious concerns regarding lack of meaningful consultation and unacceptable impacts to the cultural landscape/viewshed and anticipated four

Comment Letter P350

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September 9, 2011

Ken Salazar, Secretary
U.S. Department of Interior
1849 C Street, N.W.
Washington DC, 20240

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San Diego and Imperial Counties, California

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COUNTY
PLANNING & DEVELOPMENT SERVICES

increased public access on the project's new, proposed roads. Again, it appears that the BLM is concerned only with those impacts it alone classifies as directly impacting a cultural site - ignoring the myriad indirect, cumulative and landscape-level impacts Viejas - and other tribes - have repeatedly identified to the BLM and the applicant. Moreover, these lands are designated Class L - Limited Use - in the California Desert Conservation Area Plan; meaning, that our Tribe relied on the federal government's

word that these lands would be maintained as open space, to promote and maintain cultural resource values. Given the trajectory the BLM appears headed on this proposed project, it is likely that Viejas will have no choice but to maintain its position that Ocotillo Express must be denied.

Mr. Secretary, the situation in San Diego and Imperial Counties with energy transmission and renewable energy is out of hand. It is poised to forever change the lands of our ancestors and the irreplaceable cultural resources and places that are vital to our tribal life ways, sovereignty and self-reliance. This is our one and only homeland, we have no place else to go. These projects, as proposed, must be denied. We must work together to find more sustainable and environmentally responsible ways to meet energy needs without disregarding the views and needs of the local communities most affected by the impacts of these industrial-scale projects. I am available to directly discuss Viejas' concerns with you.

Sincerely,

VIEJAS BAND OF KUMEYAAY INDIANS

Hon. Anthony R. Pico
Chairman

Attachments:
Letter: Viejas to BLM re Tule Wind (DEIS Comments), dated March 3, 2011
Letter: Viejas to BLM re Tule Wind (Additional Comments), dated March 3, 2011
Letter: Viejas to BLM re Ocotillo Express, dated August 23, 2011

cc:
Steven Chu, Secretary of Energy
Larry Echohawk, Assistant Secretary, Indian Affairs
Jonathan Silver, Director, DOE Loan Guarantee Program
Jim Kenna, Bureau of Land Management
Hon. Barbara Boxer
Hon. Dianne Feinstein
Hon. Bob Filner
Hon. Duncan Hunter
Hon. Diane Jacob
Larry Myers, Manager, California Native American Heritage Commission
Wayne Donaldson, California SHPO
Eric Gibson, San Diego County DPLU Director
Angahim Havens, Planner, County of Imperial
Hon. Kumeyaay Leaders
Frank Brown, Chair, InterTribal Cultural Resources Protection Council

Ken Salazar, Secretary
U.S. Department of Interior
September 9, 2011
Page two

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word that these lands would be maintained as open space, to promote and maintain cultural resource values. Given the trajectory the BLM appears headed on this proposed project, it is likely that Viejas will have no choice but to maintain its position that Ocotillo Express must be denied.

Mr. Secretary, the situation in San Diego and Imperial Counties with energy transmission and renewable energy is out of hand. It is poised to forever change the lands of our ancestors and the irreplaceable cultural resources and places that are vital to our tribal life ways, sovereignty and self-reliance. This is our one and only homeland, we have no place else to go. These projects, as proposed, must be denied. We must work together to find more sustainable and environmentally responsible ways to meet energy needs without disregarding the views and needs of the local communities most affected by the impacts of these industrial-scale projects. I am available to directly discuss Viejas' concerns with you.

Sincerely,

VIEJAS BAND OF KUMEYAAY INDIANS

Hon. Anthony R. Pico
Chairman

Attachments:
Letter: Viejas to BLM re Tule Wind (DEIS Comments), dated March 3, 2011
Letter: Viejas to BLM re Tule Wind (Additional Comments), dated March 3, 2011
Letter: Viejas to BLM re Ocotillo Express, dated August 25, 2011

cc:
Steven Chu, Secretary of Energy
Larry Echohawk, Assistant Secretary, Indian Affairs
Jonathan Silver, Director, DOE Loan Guarantee Program
Jim Kenna, Bureau of Land Management
Hon. Barbara Boxer
Hon. Dianne Feinstein
Hon. Bob Filner
Hon. Duncan Hunter
Hon. Dianne Jacob
Larry Myers, Manager, California Native American Heritage Commission
Wayne Donaldson, California SHPO
Eric Gibson, San Diego County DPLU Director
Angelina Havens, Planner, County of Imperial
Hon. Kumeyaay Leaders
Frank Brown, Chair, InterTribal Cultural Resource Protection Council

RECEIVED
BUREAU OF LAND MANAGEMENT
11 OCT -6 P 2:
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

October 3, 2011

To:

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Morena Valley, CA 92553

Dear Cedric Perry:

We are opposed to construction of the Ocotillo Wind Energy Facility
As it will defile the beauty of nature of Anza-Borrego Desert State Park.
We live in Lakeside, CA, 92040, and often visit this area.

P351-01

Sincerely, Harold Stier Lambertha Stier
Harold and Lambertha Stier,
11534 GreenLane,
Lakeside, CA 92040

Comment Letter P352

Lynn Fulks
1592 Berkshire Circle
San Marcos CA 92069

BUREAU OF LAND MGMT.
11 OCT -6 PM 2:09
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

October 1, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Dear Mr Perry,

I am writing to you regarding the proposed Ocotillo Wind Energy Facility. I strongly oppose the proposed Ocotillo Wind Energy Facility due to its impact on Anza-Borrego Desert State Park (ABDSP). The Anza-Borrego Desert State Park area is not the place for this project. It is much better suited to an already disturbed and/or degraded environment.

Anza-Borrego Desert State Park and the surrounding desert may be viewed by some as a wasteland but it is an open space wonderland to the many animals that rely on it and the people who love it. I am always amazed when I visit there to meet people from all over the world who have come to see our amazing desert. Why is that people from Europe, Asia and other countries appreciate how amazing ABDSP and the animals found here are but all we want to do is find ways to make a profit from it? **P352-01**

Please don't allow 12,000 acres of intact desert habitat to be destroyed for a private for-profit project that will be de-commissioned in just 30 years. This project is not needed. Local rooftop and local distributed renewable energy generation could power the 140,000 homes that this project is slated to power. **P352-02**

Please adopt the no-project alternative and protect our amazing desert. If this project goes through, there will be irreparable damage to the landscape and ecosystem.

- Construction of this project will cause the unavoidable introduction of invasive plant species which are a death sentence to the fragile desert ecology. It will disrupt the wildlife corridors the desert bighorn sheep and other large animals need to have in order to obtain enough food and water to survive. The turbines will kill many, many birds such as the golden eagles, owls, peregrine falcons and any and all others in the vicinity.
- The turbines will also cause the death of bats from direct strikes as well as internal hemorrhaging in the lungs from the drop in air pressure. Bats are very important to the local economy as they eat tons of insects and help protect croplands. **P352-03**
- It will displace and have adverse impacts on a multitude of animals and birds, burrowing owls, long-eared owls, Vaux's swift, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, American badgers, and several listed plant species.
- Noise and light pollution from the operation of the turbines.

America is turning into one industrialized wasteland after another in the name of "progress". Don't let this happen here. ABDSP is one of the few truly wild places left in California. Please help keep its special wildness, quiet, and dark skies safe for future generations. **P352-04**

Sincerely,

Lynn Fulks

Comment Letter P353

GAIL L. ELLESTAD

2540 Grosse Ave.
Santa Rosa, CA 95404
Oct. 3, 2011

RECEIVED
BUREAU OF LAND MGMT.

11 OCT -6 PM 2:09

CALIF. DESERT DISTRICT
MORENO VALLEY, CA

Cedric Perry
Calif. Desert Dist. Ofc.
Bureau of Land Mgt.
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Re: Ocotillo Wind Energy Facility

As long time visitors to Anza Borrego State Park, I wish to add my input to the opposition to this project. The DARK SKY at Borrego is invaluable — no where else have we been able to experience this phenomenon. Once these projects are installed they can't be removed as technology improves. Wildlife & cultural resources are to be considered but the dark sky is precious. P353-01

Sincerely,
Gail L Ellestad

Comment Letter P354

RECEIVED
BUREAU OF LAND MGMT.
2011 OCT -6 PM 2:08
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

September 30, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

SUBJECT: Proposed Ocotillo Wind Energy Facility

Dear Mr. Perry,

I am concerned about the proposed Ocotillo Wind Energy Facility that is sited directly adjacent to Anza-Borrego Desert State Park (ABDSP). I do support the development of renewable energy sources, such as wind and solar, I advocate for distributed generation, the concept that this energy should be generated closer to the population centers that will consume it. P354-01

This 12,000 acre development would mar the view shed of Anza-Borrego Desert State Park from many overlooks that are popular with hikers in the park. And the famed experience of the desert, the silence, the darkness, and wide vistas would be forever changed in lands that directly border wilderness designated areas. P354-02

There would also be devastating impacts to biological resources. The highly endangered Peninsular Big Horn sheep now live in and migrate through that area and this huge development can only impact in negative ways. Bird strikes with eagles, hawks and owls, not to mention other birds and bats could be significant. Many ground dwelling species will be threatened as well including lizards, and snakes, burrowing owls. P354-03

I am also concerned that the draft EIS does not meet NEPA requirements. It does not appear to consider a full range of alternatives, including distributed generation. There is also not a "no-project" alternative. This must be an option if impacts are considered to be too disastrous. P354-04

I am opposed to this project, in any form, adjacent to ABDSP. I request that you do not approve this project. P354-05

Sincerely,

Fred Jee

Comment Letter P355

RECEIVED
BUREAU OF LAND MGMT
2011 OCT -6 PM 2:10
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

September 30, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

SUBJECT: Proposed Ocotillo Wind Energy Facility

Dear Mr. Perry,

I am concerned about the proposed Ocotillo Wind Energy Facility that is sited directly adjacent to Anza-Borrego Desert State Park (ABDSP). I do support the development of renewable energy sources, such as wind and solar, I advocate for distributed generation, the concept that this energy should be generated closer to the population centers that will consume it. **P355-01**

This 12,000 acre development would mar the view shed of Anza-Borrego Desert State Park from many overlooks that are popular with hikers in the park. And the famed experience of the desert, the silence, the darkness, and wide vistas would be forever changed in lands that directly border wilderness designated areas. **P355-02**

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I am also concerned that the draft EIS does not meet NEPA requirements. It does not appear to consider a full range of alternatives, including distributed generation. There is also not a "no-project" alternative. This must be an option if impacts are considered to be too disastrous. **P355-04**

I am opposed to this project, in any form, adjacent to ABDSP. I request that you do not approve this project. **P355-05**

Sincerely,

Kelley Jorgensen

Comment Letter P356

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BUREAU OF LAND MGMT.

11 OCT -5 PM 3:04

CALIF. DESERT DISTRICT
MORENO VALLEY, CA

September 30, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

SUBJECT: Proposed Ocotillo Wind Energy Facility

Dear Mr. Perry,

As a member of the Anza-Borrego Foundation and a resident of the region, I strongly oppose the proposed Ocotillo Wind Energy Facility that is sited directly adjacent to Anza-Borrego Desert State Park. I support the development of renewable energy sources, such as wind and solar, but this project is in the wrong location and will have a devasting impact on the significant scenic, natural, cultural and recreational resources of the region. P356-01

This project would destroy the Southern viewshed of Anza-Borrego Desert State Park from many points that are popular with hikers and motorists in the park. The proximity to designated wilderness areas, the impacts to the highly endangered Peninsular Bighorn sheep population, and the unavoidable loss of the raptors and bats that are abundant in the area all point to a project whose benefits simply do not outweigh the costs. P356-02

I am opposed to this project, in any form, adjacent to ABDSP. I request that you do not approve this project. P356-03

Sincerely,

Dick Troy, Trustee
Anza Borrego Foundation
P.O. Box 2502
Borrego Springs, CA 92004

cc: State Clearinghouse

Comment Letter P357

RECEIVED
BUREAU OF LAND M GMT
MAIL ROOM
11 OCT -7 PM 2:33
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

JOY M. JOHNSON
833 Rose Mountain Road
San Marcos CA 92069

October 3, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Dear Mr. Perry,

I am writing to you regarding the proposed Ocotillo Wind Energy Facility. I strongly oppose the proposed Ocotillo Wind Energy Facility due to its impact on Anza-Borrego Desert State Park (ABDSP). The Anza-Borrego Desert State Park area is not the place for this project. It is much better suited to an already disturbed and/or degraded environment. **P357-01**

Anza-Borrego Desert State Park and the surrounding desert may be viewed by some as a wasteland but I have found it to be one of the most amazing places on this earth that I've had the opportunity to visit. I have seen creatures here that I would only have experienced in books or in photos---I have been so fortunate to experience these sightings and hope that others may do so for a very long time. **P357-02**

Please don't allow 12,000 acres of intact desert habitat to be destroyed for a private for-profit project that will be de-commissioned in just 30 years. This project is not needed. Local rooftop and local distributed renewable energy generation could power the 140,000 homes that this project is slated to power.

Please adopt the no-project alternative and protect our amazing desert. If this project goes through, there will be irreparable damage to the landscape and ecosystem.

- Construction of this project will cause the unavoidable introduction of invasive plant species which are a death sentence to the fragile desert ecology. It will disrupt the wildlife corridors the desert bighorn sheep and other large animals need to have in order to obtain enough food and water to survive. The turbines will kill many, many birds such as the golden eagles, owls, peregrine falcons and any and all others in the vicinity. **P357-03**
- The turbines will also cause the death of bats from direct strikes as well as internal hemorrhaging in the lungs from the drop in air pressure. Bats are very important to the local economy as they eat tons of insects and help protect croplands.
- It will displace and have adverse impacts on a multitude of animals and birds, burrowing owls, long-eared owls, Vaux's swift, flat-tailed horned lizards, barefoot geckos, Red diamond rattlesnakes, American badgers, and several listed plant species.
- Noise and light pollution from the operation of the turbines.

America is turning into one industrialized wasteland after another in the name of "progress". Don't let this happen here. ABDSP is one of the few truly wild places left in California. Please help keep its special wildness, quiet, and dark skies safe for future generations. **P357-04**

Sincerely,

Comment Letter P358

9-29-11

DEAR MR. PERRY -

PLEASE NOTE WE THE UNDERSIGNED VOTERS OF BORREGO SPRINGS, ARE ARDENTLY OPPOSED TO THE PROPOSED "OCOTILLO WIND ENERGY FACILITY."

WITH 155 WIND TURBINES EACH AT A HEIGHT OF UP TO 425 FEET TALL LOCATED ON OVER 12,000 ACRES ADJACENT TO ANZA BORREGO STATE PARK IN THE VICINITY OF OCOTILLO - WE FIND IT'S INTRUSION ON THE LANDSCAPE UNEXCUSABLE. NOT TO MENTION THE NEGATIVE IMPACT ON OUR DESERTS FLORA AND FAUNA. P358-01

PLEASE REGISTER OUR PROTEST TO THIS PROJECT AND PROTECT OUR PRECIOUS ECO SYSTEM!

ALICE GOLDING 1010 PALM CANYON DR B.S. CA 92004
MELISSA McVICAR 1010 Palm Canyon Dr B.S. CA 92004
MYRNA HORN B S, CA 92004
ROBERT HORN B S. CA 92004

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2011 OCT -7 PM 2:33
CALIFORNIA DESERT DISTRICT
MORENO VALLEY, CA

ADAMS BROADWELL JOSEPH & CARDOZO

A PROFESSIONAL CORPORATION

ATTORNEYS AT LAW

520 CAPITOL MALL, SUITE 350
SACRAMENTO, CA 95814-4721

TEL: (916) 444-6201
FAX: (916) 444-6209
tenslow@adamsbroadwell.com

SO. SAN FRANCISCO OFFICE

601 GATEWAY BLVD., SUITE 1000
SO. SAN FRANCISCO, CA 94080

TEL: (650) 589-1660
FAX: (650) 589-5062

DANIEL L. CARDOZO
THOMAS A. ENSLOW
TANYA A. GULESSERIAN
MARC D. JOSEPH
ELIZABETH KLEBANER
RACHAEL E. KOSS
ROBYN C. PURCHIA

OF COUNSEL
THOMAS R. ADAMS
ANN BROADWELL

October 5, 2011

VIA FACSIMILE AND U.S. MAIL

Cedric Perry
Project Manager
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553
Fax: (951) 697-5299

RECEIVED
BUREAU OF LAND MGMT.
11 OCT 11 PM 4:01
CALIFORNIA DESERT DISTRICT
MORENO VALLEY, CA

Sean M. Moore, AICP
Planning Division Manager
Imperial County Planning & Development Services
801 Main Street
El Centro, CA 92243
Fax: (760) 353-8338

Sylvia Bermudez
Clerk of the Board of Supervisors
Imperial County
940 West Main Street, Suite 209
El Centro, CA 92243
Fax: (760) 482-4215

Re: **Withdrawal of Request for Extension of Public Comment Period on Ocotillo Express Wind Energy Project Draft Environmental Impact Statement / Environmental Impact Report**

Dear Mr. Perry, Mr. Moore and Ms. Bermudez:

We have received the September 28, 2011 letter from Mr. Armando Villa, Director of Planning & Development Services for Imperial County, denying our request for an extension of the Public Comment Period in this case. Mr. Villa points

P359-01

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out that the public review period provided for this project was 90 days, almost double the 45 day review period required under the California Environmental Quality Act ("CEQA"). In light of the length of time provided for public review, we hereby withdraw our Request for Extension letter dated September 21, 2011. Given the proximity of the deadline for submitting public comments, we also withdraw our Public Record Request dated August 30, 2011.

P359-01, cont.

Thank you for your attention to this matter.

Sincerely,

Tom Enslow

Thomas A. Enslow

TAE:vs
cc: Daniel Steward
BLM, El Centro Field Office Resource, Branch Chief

Armando Villa
Director of Imperial County Planning & Development Services

2377-010v

Comment Letter P360

HARRISON KARR
44 Blossom Drive
San Rafael, California 94901

RECEIVED
BUREAU OF LAND MGMT.
11 OCT 11 PM 4:10
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

October 6, 2011

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Re: Proposed Ocotillo Wind Energy Facility
Ocotillo, CA

Dear Mr. Perry:

I am writing to express my strong opposition to the proposed Ocotillo Wind Energy Facility near the Anza-Borrego Desert State Park. The failings of wind energy (inefficiency, bird kills, etc.) have been well-documented elsewhere. In this letter I choose to emphasize my personal observations.

I spent my childhood in the desert near Palm Springs and Indio, California. I deeply love the desert and I know the fragility and subtle beauty of the desert landscape, and the breadth and longevity of the human impacts on it.

I first saw the San Gorgonio Pass Wind Farm near White Water, California, as an adult driving into the Coachella Valley. I was horrified at the destruction wrought by the bulldozers and construction crews as they erected the wind towers. Decades later, the scars remain, and they are unlikely to be erased for centuries more. And those visible impacts are dwarfed by the less-visible impacts that project had on the plant and animal life in that area.

P360-01

When I heard that another large wind project is proposed adjacent to the Anza Borrego Desert State Park, one of my favorite desert parks, I was appalled.

In reviewing the EIS, I see that this proposed project may have significant impacts on Peninsular Bighorn Sheep and Flat-tailed Horned Lizards, significant direct and indirect impacts to nesting bird species, and degradation to habitat for several species, including golden eagles and burrowing owls. The desert is very slow to recover from human disturbance, and we have an obligation to preserve what is left. Even with the potential mitigation efforts, I consider these impacts to be completely unacceptable.

P360-02

I am an environmental attorney and an avid birder, and I consider myself to be a strong environmentalist. I support alternative energy when it can be provided in an environmentally sensitive, sustainable manner. In my view, the proposed Ocotillo Wind Energy Facility does not meet those standards.

P360-03

I strongly urge the BLM to deny this proposed project, and to determine that the right of way is unavailable to future wind energy generation projects.

Sincerely,

Harrison Karr

From: derik martin [mailto:milpas@prodigy.net]
Sent: Monday, October 24, 2011 7:37 PM
To: Raml, Teresa A
Cc: Perry, Cedric C
Subject:

The Bureau of Land Management recently denied the pubic comment opportunities at the El Centro and Ocotillo meetings for the proposed 12,000-acre Ocotillo Wind Express Energy Project on August 24th and 25th, 2011.

Public comments are an important process in the review of large projects like this. Many people would prefer to submit their comments at a meeting rather than in writing. The BLM need only provide a court reporter to record oral comments. When people travel great distances and are not permitted to speak, it appears as though the BLM has already decided to approve this project. This wind project will have negative impacts on native plants and wildlife, prehistoric cultural sites, Native American values, visual resources, private property, property values, and access to public lands. It is the responsibility of the BLM to hear all concerns associated with this project. The BLM can best accomplish this by accepting all comments in both written and oral form.

The BLM's National Environmental Policy Act Handbook States: "Public involvement begins early in the NEPA process, with scoping, and continues throughout the preparation of the analysis and the decision." Agencies are required to "make diligent efforts to involve I would like to request that the BLM hold another series of public meetings in the local communities in which oral public comments are accepted and recorded. I would also like to request a 30 day extension on the comment deadline for the Draft Environmental Impact Statement. This would allow more time for the public to prepare for additional meetings.the public in preparing and implementing their NEPA procedures" (40 CFR 1506.6(a). **LC1-01**

I would like to request that the BLM hold another series of public meetings in the local communities in which oral public comments are accepted and recorded. I would also like to request a 30 day extension on the comment deadline for the Draft Environmental Impact Statement. This would allow more time for the public to prepare for additional meetings.

Sincerely

Derik Martin
1425 Carrizo Creek
Jacumba CA

I have numerous photos of Bighorn Sheep in this area that you will decimate with your Washington DC political mentality that has nothing to do with Green Energy. I invite you to visit my modern off grid home if you want to see what real green energy is, not affecting anyone or animals or plants. **LC1-02**

Derik Martin 619-415-6498

From: Hettinger, Jack [mailto:jthettinger@IID.com]
Sent: Wednesday, October 12, 2011 12:45 PM
To: Perry, Cedric C
Subject: Ocotillo Express Draft EIS/EIR

Dear BLM, I want you to know that I feel these wind projects may be a good source of energy, but you keep on putting them on public land that is used by the public for recreational use, and you keep taking away our open areas for OHV use all over California and you don't open any land to offset what you take away. When you do this you not only take away from me but my whole family wife, daughter, and 3 grand children, in which there is no RETURN back to all of us, I am asking you to stop all of these projects on BLM land, put them on other state land that very few people use, Anza Borrego Desert, there is no off-road activity, and there is the fact that there will be dust generated near any SOLAR project that you allow to be built in the PLASTER CITY area that is no place for a solar farm either, due to the fact there is a company that is trying to put one on OHV land in Plaster City I believe 5000 acres that they are asking for, should not be allowed to be built. So in closing please do not allow these sites to be built on my off-road play ground. When I first started to go to the desert on 1965 it was all open from the border to Salton Sea to Glamis all the sand dune back to the border, hundreds of thousands of acres, now we have a very small area in Plaster City and a small area in Glamis. It is very strange but he BLM will close off a area because of a insect or a plant you say is endanger but a large company comes along with lots of money to lease it and they will receive the land to build what they want, blacktop roads cement pads lay gravel roads. What happened to the plant or insects you were protecting? Please STOP this. Thank You Jack Hettinger and family El Centro Ca.
jndhett@sbcglobal.net

LC2-01

From: Rick Huls [mailto:randphuls@gmail.com]
Sent: Friday, October 07, 2011 7:09 PM
To: Perry, Cedric C; angelinahavens@co.imperial.caus; johnrenison@co.imperial.ca.us; jackterrazas@co.imperial.ca.us; michaelkelley@co.imperial.ca.us; garywyatt@co.imperial.ca.us; raycastillo@co.imperial.ca.us
Subject: Ocotillo Express Wind Project

Cedric Perry
California Desert District Office
Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Mr. Perry,

We are writing in regards to the proposed Ocotillo Express Wind Project. We believe such a project would disrupt the wildlife corridors for the Desert Bighorn Sheep and would present a hazard to golden eagles (striking the turbines) as well as other migratory birds. This project will cause unavoidable impact to plants during construction and may introduce invasive plant species. The most objectionable impact will be the permanent scarring to the landscape; an "industrial" or "wind farm" appearance in the pristine desert habitat. We shall miss the quiet desert nights when the coyotes howl and the vast array of stars as the turbines shall surely increase noise levels and pollute the night sky with lights. **LC3-01**

Please adopt the "no project" alternative and protect this important desert habitat from devastation by private industry for private profit! **LC3-02**

Thank you for your time and consideration in this most important matter.

Sincerely,

Rick & Paula Huls

From: Chris Gruenwald [mailto:Chris@baysidenetworks.com]
Sent: Monday, October 24, 2011 9:34 PM
To: Perry, Cedric C
Subject: Ocotillo Wind Express Energy Project

To Whom it May Concern,

The Bureau of Land Management recently denied the pubic comment opportunities at the El Centro and Ocotillo meetings for the proposed 12,000-acre Ocotillo Wind Express Energy Project on August 24th and 25th, 2011.

Public comments are an important process in the review of large projects like this. Many people would prefer to submit their comments at a meeting rather than in writing. The BLM need only provide a court reporter to record oral comments. When people travel great distances and are not permitted to speak, it appears as though the BLM has already decided to approve this project. This wind project will have negative impacts on native plants and wildlife, prehistoric cultural sites, Native American values, visual resources, private property, property values, and access to public lands. It is the responsibility of the BLM to hear all concerns associated with this project. The BLM can best accomplish this by accepting all comments in both written and oral form. **LC4-01**

The BLM's National Environmental Policy Act Handbook States: "Public involvement begins early in the NEPA process, with scoping, and continues throughout the preparation of the analysis and the decision." Agencies are required to "make diligent efforts to involve the public in preparing and implementing their NEPA procedures" (40 CFR 1506.6(a).

I would like to request that the BLM hold another series of public meetings in the local communities in which oral public comments are

accepted and recorded. I would also like to request a 30 day extension on the comment deadline for the Draft Environmental Impact Statement. This would allow more time for the public to prepare for additional meetings.

LC4-01, cont.

Sincerely,

Chris Gruenwald
12409 Via Cabezon
San Diego, CA 92129

From: Steen Hillestrøm [mailto:steen@aktiefokus.dk]
Sent: Tuesday, October 25, 2011 7:17 AM
To: Perry, Cedric C
Subject: Ocotillo Wind Express Project

Dear Cedric
We have some few questions about the Ocotillo Wind Express Project.
Can you tell me a little more info about the timeline regarding the next couple of steps for the project the coming months? **LC5-01**
Also we find it quite strange that from the draft report in 2009 they want turbines from Siemens and Vestas (2,3 MW and 1,8 MW) but in the latest draft it is Siemens and General Electric (2,3 and 1,6 MW) but also the plan for a 3 MW turbine? What is correct info in all those different information? **LC5-02**

Med venlig hilsen / Best regards
Aktiefokus

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From: Susan Massey [mailto:susanlil_8@yahoo.com]
Sent: Wednesday, October 19, 2011 8:29 PM
To: Perry, Cedric C; angelinahavens@co.imperial.ca.us; jackterrazas@co.imperial.ca.us
Cc: daniel_steward@ca.blm.gov
Subject: sent wrong document for comments

Dear Mr.Perry and Ms. Havens,

On the morning of October 6 I emailed both of you, attaching my comments on the Ocotillo Wind Energy Facility. Just today I wanted to check on some information I had included and since I was not at home, I pulled up my sent email on my daughter's computer and opened the document that I had attached. I was truly horrified to see that the document I had sent was not my final copy. It is only a page and a half, and is only the in beginning of my first draft.. It is pretty obvious that it is incomplete.. My complete comments are eight pages. I really can't imagine how I could have made such a mistake, but the fact is that I attached the wrong document.

I am sending you now the correct document and would be very grateful if you could include it in the materials you will be addressing for the final EIS/EIR instead of the version I mistakenly sent on October 6.

Very sincerely,
Susan Massey
817 E 7th Street
Holtville, CA
760-356-5649 /760-554-3300

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT/REPORT
FOR THE OCOTILLO WIND ENERGY FACILITY

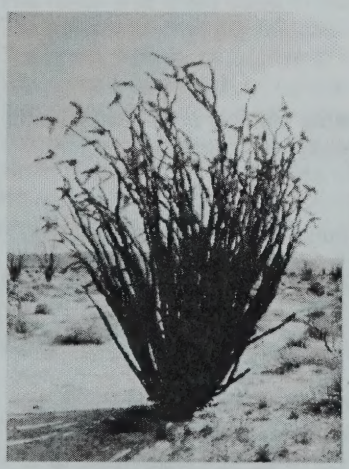
October 6, 2011

Reading the EIS/EIR for the Ocotillo Wind Energy Facility, it is clear that the Ocotillo/Nomirage area has been chosen as a sacrifice area in order to meet goals of creating jobs and developing renewable energy to decrease greenhouse gases. While these are valid goals, they could be met by other less destructive means. Instead of backing a loan for Pattern Energy, the government could back loans for individuals to insulate their homes and to put solar panels on their roofs. They could also back loans for businesses to build solar panel covered parking shelters. The loans could be paid back with money saved on electricity. This would accomplish the goals of reducing greenhouse gases, providing jobs and it would also make life more pleasant for Imperial Valley residents during the summer. These suggestions should be listed as a project alternative.

LC6-01

Sacrifice is a strong word, but there is justification for using it. County officials may be familiar with the Ocotillo/Nomirage area, but officials in BLM living in Washington are not. There are two things that make the area an attractive place to live or visit: beautiful views and quietude.

I am a Holtville resident, but I have been visiting the Ocotillo area for over 20 year to hike and take pictures. I took my children with me and now I'm looking forward to taking my two year old granddaughter. I am inserting two pictures I took right outside of Ocotillo the spring of 2010. While the photos in the EIS are much more professional than mine, they do not capture the beauty of the colors of the mountains in early morning and late afternoon light nor the colors of the vegetation in the spring.



In analyzing six key observation points the EIS/EIR finds that the visual change in each case would be moderate to high and would "substantially degrade the existing visual character or quality of the site and the surrounding landscape." (These words are repeated throughout Section 4.18 Visual Resources.) Table ES-1: Comparison of Impacts by Alternative states that the visual impacts for Alternatives 1, 2 and 3 mean "Temporary and permanent degradation from visual changes." **LC6-02**

The quietness is also being sacrificed to build this project. On page 4.9-7 of the Noise section it states ". . . these noise levels would result in a substantial increase over nighttime ambient noise levels occurring in the quieter areas (away from highways) and would be perceived as a doubling of loudness (>10 dBA Leq increase). . . . Therefore, these noise levels may result in complaints from local residences." On page 4.9-11, in discussing CEQA criteria , it states ". . . these noise levels may result in widespread complaints from local residences resulting in a significant and unavoidable impact under Criterion NZ-1" **LC6-03**

A multitude of articles from around the world have been written about the adverse effects of wind turbines on health. Yet in the Public Health and Safety section of the EIS/EIR, only three paragraphs are dedicated to the health problems reported to be caused by proximity to wind turbines in operation. Dr. Sarah Laurie, medical director of the Waubra Foundation in Australia states, "*BE ADVISED* that, as a result of information gathered from the Waubra Foundation's own field research, and from the clinical and acoustic research available internationally, *the following serious medical conditions have been identified in people living, working, or visiting within 10km of operating wind turbine developments*. The onset of these conditions corresponds directly *with the operation of wind turbines:*

- chronic severe sleep deprivation;
- acute hypertensive crises;
- new onset hypertension;
- heart attacks (including Tako Tsubo episodes);
- worsening control of preexisting and previously stable medical problems such as angina, hypertension (high blood pressure), diabetes, migraines, tinnitus, depression, and post traumatic stress disorder;
- severe depression, with suicidal ideation;
- development of irreversible memory dysfunction, tinnitus, and hyperacusis.

LC6-04

http://waubrafoundation.com.au/~waubra/Y2NpZD0xJmNhaWQ9MTMmYWlkPSZjcmM9MTQ0OTg1MjMyOA%3D%3D

In his study, *Wind Turbine Noise, Sleep and Health*, Dr. Chris Hanning, a British specialist in sleep disorders says, "There can be no reasonable doubt that industrial wind turbines whether singly or in groups ("wind farms") generate sufficient noise to disturb the sleep and impair the health of those living nearby and this is now widely **LC6-05**

accepted." http://www.windvigilance.com/about-adverse-health-effects/wind-turbine-noise-sleep-and-health-by-dr-hanning

In a 2008 study, Eja Pederson (whose studies are quoted in the EIS/EIR states that "Annoyance with wind turbine noise was associated with psychological distress, stress, difficulties to fall asleep and sleep interruption."

Various articles suggest that the problems of residents close to wind turbines are related to the fact that the noise is low frequency. Low frequency sound is not well attenuated by walls and sometime resonates more within a room than on the outside. The Society for Wind Vigilance cites several studies by Pederson and says that "peer reviewed articles based on studies of European wind turbine facilities have concluded that wind turbine noise is more annoying than equally loud noise sources such as airport and traffic." http://www.windvigilance.com/about-adverse-health-effects/annoyance-and-wind-turbines#_ednref9 Other explaining factors for this phenomenon are wind turbine amplitude modulation and temporal variability. The effect of these factors should be discussed in the final EIS/EIR.

Researchers seem to agree that not everyone near wind turbines is equally affected and there may be individual physiological differences which explain this. Dr. Nina Pierpont, whose work is cited in the EIS/EIR states, "My data suggest, further, that young children and adults beyond age 50 are also at substantial risk." (emphasis is mine) http://www.wind-watch.org/documents/wind-turbine-syndrome-3/

LC6-05, cont.

In 2004, H. G. Leventhall did a study of noise complaints regarding low frequency environmental noise. He concluded that
"The problems arose in quiet rural or suburban environments
The noise was often close to inaudibility and heard by a minority of people
The noise was typically audible indoors and not outdoors
The noise was more audible at night than day
The noise had a throb or rumble characteristic
The main complaints came from the 55-70 years age group (emphasis is mine)
The complainants had normal hearing.
Medical examination excluded tinnitus."
He states that " These are now recognized as classic descriptors of low frequency noise problems."

This data is quoted in a 2009 study by the Minnesota Health Department entitled *Public Health Impacts of Wind Turbines.*
http://energyfacilities.puc.state.mn.us/documents/Public%20Health%20Impacts%20of%20Wind%20Turbines,%205.22.09%20Revised.pdf

There are many opinions on the appropriate distance for offsets. According to the EIS/EIR there is only one study that was relevant to the question of the distance large turbines must be located from houses. That study suggested that an offset of 1.25 miles was adequate. The document insists that more studies are necessary, but in the meantime the proponent has placed the windmills within .75 miles of the majority of

houses. Why is there not a recommendation in the EIR to err on the side of caution and have a larger offset?

The noise level at night in the project area is of particular concern. Dr. Chris Hanning says that the variable noise of wind turbines cause some people to wake up frequently or to go from a deeper to a lighter level of sleep many times during the night. In either case, the person feels tired in the morning. We all know how hard it is to get through the day when we haven't slept well the night before. No one should be forced to suffer sleep disruptions 365 days a year!

LC6-05, cont.

In *Wind Turbines and Health*, K Rideout and others state "Annoyance and sleep disruption are common when sound levels are 30 to 45 dBA." http://www.ncceh.ca/files/Wind_Turbines_January_2010.pdf. The Minnesota Department of Public Health study quotes the World Health Organization as recommending "30 dB(A) as a limit for ;a good night's sleep'". The noise levels at the nearest residences are predicted to range from 43.1 to 37.8 dBA Leq. (page 4.9-7)

The EIS/EIR discusses the project's effect on property values in the Social and Economic Issues section. The document cites a large study done at the Berkeley National Lab which concluded that property values did not go down in areas near wind turbine projects. But the document does not mention that this study was heavily criticized by some experts. Albert R. Wilson, author of *Environmental Risk: Identification and Management*, wrote a detailed six page critique of the statistical methodology used in the Berkeley National Lab study. He states that less than 10 % of the sales transactions in the report had any view of turbines, and that only 2.1% had a view rated greater than minor. The study was dominated by transactions where no influence is reasonably likely." http://www.masterresource.org/2010/02/is-doelawrence-berkeley-labs-wind-power-impacts-study-junk-science/

Keep in mind that all the houses in Ocotillo and Nomirage will have full views of a great many turbines.

LC6-06

The Berkeley study was also criticized by Michael S. McCann, a state certified real estate appraiser. He said that data he supplied to the study was left out. He said the majority of data related to homes more than five miles from the turbines and that the report fails to talk about homes that took over 800 days to sell or were not able to be sold at all. http://amherstislandwindinfo.com/mccann-hoen-review-total.pdf The EIS/EIR mentions other studies related to other types of power lines or power plants, however it's hard to compare any other type of installation with being surrounded by 155 four hundred foot giants. In considering home values specific to the Ocotillo/Nomirage area, the EIS should take into account that in a place where you have to drive a half hour to a doctor, supermarket, restaurant or a movie, the desert views and the tranquility that now exists there are really the only things that make the area desirable.

So the two best qualities of the area are clearly being sacrificed to make way for this project. Knowing people who live near the project area on very low incomes, I carefully read the section on Environmental Justice. I see that according to the BLM criteria for

LC6-07

the demographics needed for environmental justice to be considered an issue this area doesn't qualify doesn't qualify using 2000 census. However, I notice the comment on page 3.5-1 stating that "The approach in this EIS/EIR is to achieve compliance with the letter and the spirit of the President's Executive Order by addressing the question of whether and how the impacts of the Proposed Action and alternatives may disproportionately affect minority and low income populations."

I challenge that the methodology and the data applied here is following the spirit of the law and possibly the letter of the law.

The Ocotillo/Nomirage area clearly doesn't qualify on the basis of having a high minority population. However the consideration of it being in a low income area is thrown out in the analysis on the basis of census tract block groups (page 4.5-2). There is no map of these block groups nor explanation of what areas they include. Please provide this information in the final document.
(Online maps of census tracts and block groups are difficult to decipher)

The Environmental Justice section relies only on 2000 Census data. This is understandable as this work may have been done before the 2010 census was even completed. However the last decade has brought radical economic and demographic changes to the state and to this area of Imperial County. It is now October of 2011, so please include data from the 2010 census.

LC6-07, cont.

I have been unable to find official 2010 census data for Ocotillo in relation to income and age. As a federal agency I'm sure that you will be able to obtain it. .Using data from the Census Bureau's American Fact Finder and from several other online sources the following picture emerges. Ocotillo/Nomirage is of a very small rural community that is significantly poorer and older than Imperial County as a whole. (It's important to note that Imperial County itself is the poorest county in California.) There is an estimated median household income of $19,402 as compared to $38,594 for Imperial County and $58,931 for the state. There is a median age of 48.4 years for residents of Ocotillo. Median age for Imperial County is 30 years and for California it is 33.3. These statistics come from www.city-data.com. The American Fact Finder on the Census Bureau's website estimates that the median age for Ocotillo residents between 2005--2005 was 60 years in contrast to a U. S. median age of 36.5. According to 2010 census data cited on Wikipedia, 68 percent of residents were above 44 years old. According to this EIS/EIR, the median value of a home is Ocotillo is 2011 was $99,000 compared to $134,000 for Imperial County.

While age is not a criteria for the BLM under the environmental justice guidelines, when talking about a project which may have deleterious health effects, it is clearly unjust to place it in an aging population in which people are already suffering from health issues. And according to Dr. Pierpont and also H. G. Leventhall, older people are particularly sensitive to the health problems caused by low frequency noise.

LC6-08

It is unfair to change an area that is currently zoned desert residential to one that will have an industrial nature. And it is especially unfair when the members of the community are demonstrably poorer than others in the poorest county in California and therefore less able to move if they find their health threatened. The lower prices of their houses makes it very difficult to sell and purchase in another area. **LC6-09**

Please do not amend the CDCA plan to permit wind energy development on this land. Do not change county zoning. Please approve Alternative 5 and approve a land use amendment which would exclude wind energy and also solar energy development on this land. **LC6-10**

Susan Massey
817 E. 7th Street
Holtville, CA 92550
760-356-5649

Comment Letter LC7

From: Jacob Sierra [mailto:jacobbsierra@gmail.com]
Sent: Monday, October 17, 2011 4:14 AM
To: Perry, Cedric C
Subject: Wind Farm

Some of the fondest memories of childhood where our camping trips to the ABDSP. As far back as I can remember I would look forward to holiday weekends where my family would gather in the desert and enjoy the beauty. I looked forward to taking my own children out to enjoy what I did as a child. Since the birth of my first child 7 years ago, I have been taking my own family to enjoy an eyesore free desert. I am currently deployed to the mountainous region of Eastern Afghanistan and just got word of this proposed project that could forever alter the beauty of what I consider to be a home away from home. I urge all involved to reconsider this proposal and seek alternatives. I would like nothing more than to continue taking my extended family to enjoy the beauty of the ABDSP after my arrival back home next year.

LC7-01

From: jbarber13@gmail.com [mailto:jbarber13@gmail.com]
Sent: Tuesday, October 25, 2011 11:08 AM
To: Kastoll, Valerie A; Blevins, Karissa M; mwest@ca.blm.gov
Subject: elcentro feedback

name = Jose Barber
organization =
email = jbarber13@gmail.com
subject = Ocotillo Wind Express Energy Farm Proposal FeedbackType = Comment request_comment = To Whom It May Concern,

Please reject the Ocotillo Wind Express Wind Farm proposal from Pattern Energy as it would be not only a major eyesore that would decrease the pristine desert views of that area, but it would also infringe on recreationists\' utility of the area.

I understand that the public comment period is over, but am just now reading of this proposal on local San Diego websites. Please listen to the residents of the area as well as the thousands of San Diegans who frequently travel through and also who use the public land for family adventure and quality life experiences.

While I understand the increasing trend of renewable energy resource expansion, I feel this proposal is ill placed and not in the best interest of the area nor the beneficiaries the project or the residents near the site. The solar farm slated to be constructed near the Plaster City plaster plant is going to already be a detriment to the natural s!
etting in this region, but the 400+ foot tall wind turbines would simply spoil whatever beauty remains post installation.

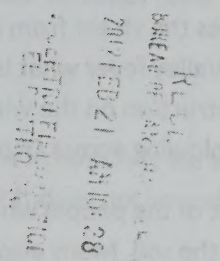
If at all possible, please keep the beauty of this majestic desert unspoiled.

Thank you
username123 =
sentinal = Sentinal
page_referred_from = http://www.blm.gov/ca/st/en/fo/elcentro/nepa/ocotillo_express_wind.html
fo = 8
Submit = Send Request

LC8-01

Comment Letter LC9

February 18, 2012



Board of Supervisors;

BLM

Planning Department

We also know that you the Supervisor are being pressured by Governor Brown by the President Obama for renewal energy. BUT, you cannot believer the danger you will be putting on the Citizen of Ocotillo, and Nomirage. The Medical reasons alone should have stopped BLM and the Planning Commission from letting this project get this far. Not to say the Board of Supervisor.

Valley Fever has been prevalent in the Valley since the 1950s. It is very real and dangerous, the symptoms are like flu doctors have a hard time in diagnosing this disease. Normally it takes two different types of testing to diagnose Valley fever. One is blood work, the other is a biopsy. There have been 265 deaths reported between 2001 and 2008 from Valley fever.

Valley fever is linked, to about three other prevalent diseases; Alzheimer's, Lou Gehrig's disease, and Parkinson disease. By disturbing the first 12 inches of the desert floor you have opened the door for the spores to become airborne. All it takes is one spores for a human to breathe to become infected with Valley fever. Plaster city and Cencetinela State Prison are directly east of the proposed project they will be in the line of fire for contacting Valley Fever because of the dust which will become airborne. The spores are in the fine dust that has been disturbed. The dust can travel for hundreds of miles when the wind blows, so now we are looking in the area of hundreds of miles that people can be infected with this fever. Valley Fever is not only for people but also for animals to be infected. You cannot contract Valley fever from people to people it also infects animals. You get it from the spores that are in the fine dust. Imperial County is listed as one of the hotspots.

LC9-01

Mr. Brown has Valley fever was diagnosed at Kaiser Hospital in San Diego. Mr. Brown also is across the street from me and my mother. This disturbs me very much because if Mr. Brown has Valley fever what is this going to do to the rest of the community, when they start construction on the wind turbines, with the dominant winds are coming from the West, and are blowing across Ocotillo and Normiage. There has never been enough study on this disease.

Most of the people who get the disease are people who live in or visit places where the fungus is in the soil. Many also engage in activities that expose them to the dust (such as construction, archaeological work, military field training and archaeology exploration), so you are actually going to be disturbing virgin ground and releasing the spores in the air. It has also been reported in our penal systems, and our military bases; Valley fever is very prevalent in these areas.

Valley fever, is reported in the Western 11 states; starting at let's say San Joaquin Valley, Banning, Palm Springs, Camp Roberts, Lompoc, Fillmore, Moorpark, Canoga Park, Los Angeles, Lancaster, Mohave, Barstow, Needles, San Bernardino, Colton, Riverside, Orange County, Lake Elsinore, Blythe, San Diego, El Cajon, Winter Haven, Imperial County and the surrounding areas the average incidence of positive reaction 20% and better with Valley Fever; Also, Phoenix Arizona and Tucson Arizona. As you see Valley fever is all around us it has to be taken very seriously this is nothing that we can fool around with.

LC9-01, cont.

It is also come to our attention, that doctors have a hard time diagnosing Valley fever. They do not want to diagnose it for reasons that are unclear to me and other people. It is a reportable disease to CDC most communities do not want to hear about Valley fever. Valley fever alarms Business Owners, County Officials and anyone in the archaeological and construction field because of the danger to their workers.

About 20% of infections do not cause any symptoms. On some people who develop symptoms may experience a flulike illness, with fever, cough, headaches, rash and muscle aches. Most people make a recovery within weeks to months of systems onset, but a number of people may develop chronic pulmonary infections or widespread disseminated infections. When the infection spreads outside of the lungs, its most commonly result is in lesions, central nervous system infection, such as meningitis and bone and joint infection. You have to remember that the people of Ocotillo and Normiage are retired and are here for their health reasons.

What Is Valley Fever, is a fungal disease caused by Coccidioides species. These organisms live in the soil of semiarid areas. It is epidemic in areas such as the Southwestern United States, parts of Mexico and South America. It is a reportable disease in states where the disease is endemic, such as California, New Mexico, Arizona and Nevada plus Yuma Arizona. Of people

who live in epidemic region, about 10 to 80% will have evidence of exposure to Valley fever. The numbers keep going up the more I have researched this disease.

LC9-01, cont.

We are not mighty in numbers in Ocotillo and in Normirage but we are few in numbers we will fights these turbines. This is our homes and our life savings, in saying that it does not sound like much but it is to us.

Sincerely yours;

Barbara J. Hill

Barbara 9446@att.net

760-996-0612

Comment Letter LC10

From: Edie Harmon [mailto:desertharmon@gmail.com]
Sent: Tuesday, February 21, 2012 8:51 PM
To: Zale, Thomas; Zale, Thomas; Perry, Cedric C
Subject: Cyanobacterial toxins, desert crusts & neurodegenerative diseases - potential for health problems if desert crusts are disturbed and biological materials end up being moved off site with dust

Tom,

I am hoping you get this. Sorry about the delay, but computer problems are still with me. Just to be sure, I have copied the attachment into this message. I believe that I probably covered the valley fever issues in the comments on the DEIS in October. But I have a long list of references. I will try to get some additional details about both valley fever and neurodegenerative diseases in Imperial County. Because Jim had Parkinson's Disease, I have personal reasons to be concerned about any potential additional environmental triggers that could pose problems for those exposed to biological materials in desert crusts, whether those materials are bacteria, fungi, viruses or heavy metals. Form my reading, it seems that there may be multiple factors associated with neurodegenerative diseases in sensitive persons. And, as you know, there is a very high incidence of asthma, allergies and compromised immune systems for persons residing in Imperial County. Air quality issues in the County have been controversial for a long, long time. Thye proposed industrial scale wind and solar projects on public lands managed by BLM in addition to those proposed for other lands in Imperial County are not likely to make the situation any better. I was unaware of the connection between cyanobacteria in desert crusts and neurodegenerative diseases in deployed military at the time of the comment deadline for the Ocotillo Express Wind Project.

LC10-01

Thank you.

Edie Harmon

Cyanobacterial toxins may cause neurodegenerative diseases when curst is disturbed and materials are transported with airborne dust - - A public health concern related to surface disturbing activities associated with industrial scale wind turbine and solar projects on relatively undisturbed desert public lands managed by Bureau of Land Management.

In the past two weeks there have been published articles in newspapers referring to medical journal articles describing incidences of neurodegenerative diseases such as Lou Gehrig's Disease (ALS), Alzheimer's Disease (AD) and Parkinson's Disease (PD) following exposure of deployed military members to dust containing cyanobacteria and other materials in Gulf Wars and Iraq and Afghanistan. Some research is about a decade old, but only recently being discussed in widely circulated newspapers and magazines.

Please copy the following to see the article in USA Today. "Navy researcher links toxins in war-zone dust to ailments." Kennedy, K. 2011-05-11 USAToday.

http://www.usatoday.com/news/military/2011-05-11-Iraq-Afghanistan-dust-soldiers-illnesses_n.htm and its accompanying video. http://bcove.me/rz7zs7z6

Cyanobacteria are in the upper mm of desert souls worldwide. A brief discussion of the desert crusts and cyanobacteria by USGS's Jayne Belnap is found at http://geochange.er.usgs.gov/sw/impacts/biology/crypto/ Belnap states that:

> Cryptobiotic crusts increase the stability of otherwise easily eroded soils, increase water infiltration in regions that receive little precipitation, and increase fertility in soils often limited in essential nutrients such as nitrogen and carbon (Harper and Marble, 1988; Johansen, 1993; Metting, 1991; Belnap and Gardner, 1993; Belnap, 1994; Williams et al., 1995). (Belnap, USGS p 2)

LC10-01, cont.

Cryptobiotic soil crusts are highly susceptible to soil-surface disturbing activities such as trampling by hooves or feet, or driving of vehicles off road, construction activities including road construction/grading. (Belnap, USGS p.2) Because desert crusts are easily disturbed the "underlying soils are left vulnerable to both wind and water erosion for at least 20 years after disturbance (Belnap and Gillette, 1997)". This loss of soil and fertility is considered irreversible because desert soils can take 5,000 to 10,000 years to form in arid areas.

"Cyanobacteria can generate molecules hazardous to human health." (Cox, et al. 2009 p. 109) Cyanobacteria have been found in the fossil record for more than 2.2 billion years. They have been around long enough to adapt to the most extreme of environments and are important in both the nitrogen and carbon cycles in the desert environment. They can be found at the extreme limits of life. Many taxa of cyanobacteria are considered as "extremophiles" because they are able to occupy and survive in extreme environments including extreme temperatures, salinity and aridity. And because they can survive at the extremes, they have been important in stabilizing desert soils wherever they occur. (Cox, et al. 2009 p. 110.)

Cyanobacteria are known to produce three types of toxins, neurotoxins, hepatotoxins and irritant

toxins. (Cox, et al. 2009 p. 110.) The majority of cyanobacteria produce toxins that produce acute health effects. Among other things, toxins are known to inhibit acetylcholinesterase, inhibit protein phosphotase, promote tumors and cause gastrointestinal problems. In addition, long term exposure to low levels of cyanobacterial toxins has also been found to lead to a higher incidence of primary liver cancer and progressive neurodegenerative diseases like Lou Gehrig's disease (ALS). (Cox, et al. 2009 p. 110.) Such exposure to cyanobacteria in desert dusts has been linked with higher than expected ALS in young, previously healthy military persons deployed in the first Gulf War and exposed to cyanobacteria in the desert crusts that were disturbed by military vehicles. Authors suggest that there might be a long term increase in neurodegenerative diseases such as ALS, PD and Alzheimer's in the future as the slow release of neurotoxins in the brain result in motor neuron death.. (Cox, et al. 2009 p. 113-115.)

, Cox et al. (2009 p. 109) found that the dried desert crusts and mats (in the Gulf region) contained neurotoxic cyanobacterial toxins including BMAA and DAB. The abstract concludes with the following text:

> "If dust containing cyanobacteria is inhaled, significant exposure to BMAA and other cyanotoxins may occur. We suggest that inhalation of BMAA, DAB, and other aerosolized cyanotoxins may constitute a significant risk factor for the development of ALS and other neurodegenerative diseases." (Cox et al. (2009 p. 109)

> A study by Pablo *et al.* [34] detected high concentrations of BMAA in 49 out of 50 postmortem brain samples from ALS and AD sufferers in North America, and importantly, no BMAA was detected in healthy controls. This provided further evidence that bioaccumulation of BMAA in neurodegenerative disease sufferers may be a global concern. (Chiu et al 2011, p. 3731)

LC10-01, cont.

Because inhalation of cyanotoxins from desert crusts may cause neurodegenerative diseases, and because cyanobacteria and cyanotoxins have been considered as possible bioweapons, (Cox, PA. et al. 2009. P. 116) and because cyanobacteria are found in all desert crusts, including in the California deserts, serious consideration should be given to the potential for significant serious long term debilitating health problems of sensitive persons downwind of the blowing dust from disturbed desert soils if industrial scale wind energy projects are constructed on desert public lands managed by BLM..

This should be especially important in a location such as Imperial County where residents are already exposed to the drift of airborne agricultural chemicals such as pesticides and herbicides that are sprayed from low flying aircraft over agricultural fields. Imperial County has a "Right to Farm Ordinance", which essentially advises property owners about agricultural practices, many of which have been associated with adverse health impacts such as asthma, allergies, PD in publications for many years. One must ask whether and/or to what extent might the inhalation of airborne cyanobaterial toxins, other soil bacteria and fungi co-contribute to health problems both locally in downwind communities and hundreds of miles away as the dust is transported off site?

Indeed, an article from Reuters suggests health problems exacerbated by transport of dust from

distant desert lands when it states that: Dust blown from faraway deserts may accumulate in the air to levels great enough to contribute to children's asthma attacks, a new study suggests." (Norton 2010.) http://www.reuters.com/assets/print?aid=USTRE6754MS20100806 So what might happen if that desert dust also carries fungal spores that cause Valley fever or cyanobacterial toxins from the desert crust?

There are many more articles in medical publications giving details of cyanobacterial toxins, desert crusts, and neurodegenerative diseases. I can provide a more extensive list, but computer problems mean that will have to wait.

Jayne Belnap USGS Desert crusts. http://geochange.er.usgs.gov/sw/impacts/biology/crypto/

Chiu, A.S. et al. 2011. Does -Amino- -methylaminopropionic Acid (BMAA) Play a Role in Neurodegeneration? Int. J. Environ. Res. Public Health 2011, 8, 3728-3746

Cox, PA. et al. 2009. Cyanobacteria and BMAA exposure from desert dust: A possible link to sporadic ALS among Gulf War veterans. Amyotrophic Lateral Sclerosis, Supplement 2 109-117.

Kennedy, K. 2011-05-11 USAToday. "Navy researcher links toxins in war-zone dust to ailments."

http://www.usatoday.com/news/military/2011-05-11-Iraq-Afghanistan-dust-soldiers-illnesses_n.htm and its accompanying video. http://bcove.me/rz7zs7z6

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LC10-01, cont.

Comment Letter EC1

IIPAY NATION of SANTA YSABEL

P O Box 130 • Santa Ysabel, CA 92070
Tele: (760) 765-0845 • Fax: (760) 765-0320

Chairman Virgil Perez
Vice Chairwoman Brandie Taylor

RECEIVED
BUREAU OF LAND MANAGEMENT
2011 SEP 16 PM 12: 23
EL CENTRO FIELD OFFICE
EL CENTRO, CA.

September 12, 2011

Bureau of Land Management
ATTN: Margaret Goodro, Field Manager
1661 South 4th Street
El Centro, CA 92243

Dear Ms. Goodro,

On behalf of the Iipay Nation of Santa Ysabel, I am writing to let you know how disappointed I am concerning the treatment of Tribes by your office.

When the President signed the Executive Order to consult with Indian Tribes concerning issues that affect them I was excited by the opportunity to express our Tribal concerns. But from what I have been informed the opposite is true. First, the Tribe is aware of the limited participation at public hearings. The Executive Order directs government agencies to hold meaningful consultations with Indian Tribes. In our opinion this process falls far short of the word meaningful. **EC1-01**

Second, the limited amount of time to comment on Draft Environmental Impact Report, we support the position of the Viejas Tribe to extend the time limited to November 15, 2011 to allow maximum comments from tribes **EC1-02**

Third, the Tribe supports cultural training whenever there is a new hiring of personnel, especially when their archeological perspective is the only perspective. We understand that the newly hired person incorrectly recorded cultural resources sites without indicating human remains. This lack of knowledge of what constitutes cultural resources is unacceptable. **EC1-03**

Finally, whenever the Tribe decides to visit impacted areas we would appreciate correct maps of the site of the impacted areas. **EC1-04**

If you would like me to clarify any of the above concerns please contact me at the above number.

Sincerely,

Virgil Perez, Tribal Chairman
c.c. Viejas Tribe

Comment Letter EC2

VIEJAS
TRIBAL GOVERNMENT

P.O Box 908
Alpine, CA 91903
#1 Viejas Grade Road
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Phone: 6194453810
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viejas.com

Anthony R Pico, Chairman
Robert Cita Welch, Vice Chairman
Anita R. Uqualla, Tribal Secretary
Samuel Q Brown, Tribal Treasurer
Greybuck S Espinoza, Councilman
Victor E. Woods, Councilman
Raymond "Bear" Cuero, Councilman

October 12, 2011

Bureau of Land Management
California State Office
Attn: Mr James G Kenna, State Director
2800 Cottage Way, Suite W1623
Sacramento, CA 95825

RECEIVED
BUREAU OF LAND MANAGEMENT
2011 OCT 17 PM 12: 05
EL CENTRO FIELD OFFICE
EL CENTRO, CA.

Re: Ocotillo Express

Dear Mr. Kenna:

Please accept this letter on behalf of the Viejas Band of Kumeyaay Indians regarding continuing concerns we have relating to the Ocotillo Wind Draft Environmental Impact Report/Statement (DEIR/S)

We have received the Draft Archaeological Survey Report for Ocotillo Express which apparently was sent to us on October 4, 2011. However, this report was not received until Friday, October 7, 2011. While the report was available on an FTP site, many tribal representatives and staff members lacked the capabilities of accessing the report online. Those who were able to finally access the report discovered numerous references to information contained in the confidential appendices. Those appendices were not included, and the only person who appears able to release them is on vacation. A request has been made for that information, and we are informed that some of the appendices have not been completed and are therefore not yet available. As a result, the report that was provided to tribes, and is an important part of our analysis of the DEIR/S, is incomplete

EC2-01

Please also be advised that some tribal representatives received correspondence from the El Centro Field Office indicating that comments on the DEIR/S would be fully considered, but other tribal representatives received correspondence stating their comments would be considered only to the extent practicable We respectfully request the legal authority that allows the BLM to give more weight to some tribal comments than others That the BLM has expressed limitations on the extent to which some tribal commentary will be included in the NEPA (and CEQA) process is alarming for two reasons: first, the willingness to disregard some information for some tribes but not for others raises serious issues of bias and integrity in the consultation process Second, tribal representatives were notified by email and voicemail of the extension and relied on those communications as assurance that they would timely receive a complete report and be allowed to fully comment It would appear now that this is not the case Viejas requests that the opportunity to fully comment be applied to all tribes

EC2-02

The incomplete report and its late receipt severely restricts the ability of any tribe to review the information and formulate comments on the report itself and on the DEIR/S by the November 4, 2011, deadline As a result, we are requesting that the November deadline to comment be extended until sometime in 2012 to allow tribes sufficient time to review the archaeological report, the technical reports, the information contained in the now unavailable appendices, make site visits, confer with tribal elders, spiritual leaders and culture-keepers and formulate comments

EC2-03

While we appreciate your willingness to extend the comment deadline to November 4, we are still forced to request an additional extension because this deadline does not take into account the internal tribal protocols and processes for reviewing and commenting on technical documents of this nature If you recall from the September 21 and 22 meetings with a small group of tribes in Palm Springs, BLM representatives were requesting cultural resources information from tribes within a 45-day time frame relating to the Draft Renewable Energy Conservation Plan (DRECP) Notwithstanding that the BLM had not been engaged in consultation with tribes prior to the request, the representatives explained to the BLM that these types of timeframes are untenable for tribes

EC2-04

When dealing with tribal cultural resources, we often must abide by certain protocols, including consultation with elders of our or other tribes and in some cases even specific ceremonies, to acquire information and the permission to share the information the BLM is seeking. Often questions arise as to the nature and location of the site, and site visits are necessary. This process does not lend itself to arbitrary BLM timeframes, and the continued failure of the BLM to work with tribes in establishing appropriate timeframes for these information exchanges is a demonstration of the BLM's inability and/or unwillingness to engage with tribes in meaningful consultation. Meaningful consultation should include sincere, open and informed dialogue that is mindful of the tribe's needs and recognizes internal tribal protocols. Meaningful consultation is not the issuance of a demand for sensitive information to be provided within an arbitrary period of time. Moreover, refusing to provide an extension prevents tribes from engaging in meaningful consultation pursuant to Section 106 of the National Historic Preservation Act and various federal directives and policies including Executive Orders.

EC2-05

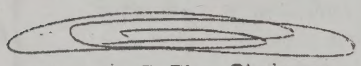
Viejas understands the interest in developing renewable energy projects, but we are concerned that current renewable energy proposals are being considered *without* a clear, well-considered strategy that was created through meaningful consultation with the tribes. In the discussion about extending the timeframe for tribes to provide information to you for aspects of the DRECP, a representative of the BLM stated that the longer tribes took to consult on the DRECP, the longer tribes will be stuck with the current permitting process and the projects that are being proposed now. This is simply not true. The BLM as the lead agency has the authority to approve or disapprove these projects. The BLM as the lead agency *and* as stewards of public lands has the authority and the *duty* the ensure compliance with the existing legal framework in which these project applications are made, particularly where tribes and the general public have raised serious concerns. The BLM is *not* obligated to accept incomplete applications or studies, nor to approve them. The BLM *is* obligated to discharge consultation duties under a number of federal laws, including NHPA, regulations and executive orders *and* pursuant to its trust obligation as a federal agency. The BLM has not discharged its duty with regard to the Ocotillo Express project, or the Tule Wind, ECO Substation or Sunrise Powerlink projects to name a few.

EC2-06

Viejas reiterates its request to extend the deadline for tribal comment from November 4, 2011, to after January 1, 2012. We appreciate your immediate attention to this matter. Please contact Ms. Kimberly Mettler at 619-659-1710 with any questions.

EC2-07

Sincerely,



Anthony R. Pico, Chairman
Viejas Band of Kumeyaay

Copy to:
Tribal Leaders
Margaret Goodro, BLM Field Manager El Centro
Department of Energy, Loan Program Office
Bureau of Indian Affairs
Army Corps of Engineers
Anne Ardillo, USEPA
John Fowler, ACHP
Wayne Donaldson, California SHPO
Dave Singelton, NAHC
California Public Utilities Commission
California State Lands Commission
InterTribal Cultural Resource Protection Council
Interested Parties

Comment Letter EC3

THE COCOPAH INDIAN TRIBE

COCOPAH TRIBAL OFFICE
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Fax: (928) 627-3173

August 12, 2011

Margaret Goodro
Field Manager
El Centro Field Office
Bureau of Land Management
1661 S. 4th Street
El Centro, CA 92243

RE: Ocotillo Wind Energy Facility (OWEF), Ocotillo, California

Dear Ms. Goodro:

Upon receiving the Draft Plan Amendment and Draft Environmental Impact Statement/Environmental Impact Report (DPA, DEIS/DEIR) for the Ocotillo Wind Energy Facility (OWEF) project in June 2011, we felt it necessary to relay to you some of our concerns with the progress of this project, and the relationship between the Cocopah Indian Tribe and the Bureau of Land Management El Centro Field Office (BLM ECFO) regarding consultation on this project.

1. Tribal Consultation: Section 5.2.3 Tribal Consultation from the Draft Plan Amendment and Draft EIS/EIR (DPA, DEIS/DEIR) June 2011 states that the BLM invited Tribes to consult on the OWEF on July 28, 2010 and made earlier consultation efforts in November 2007 and February 2010 and that BLM also invited Tribes to a Section 106 and Government-to-Government meeting on May 12, 2011. The 2007 and 2010 dates served only to notify tribes of the project ROW and that meteorological testing was being proposed; no specific project

EC3-01

information such as number and size of wind turbines, or effects to cultural and environmental resources were discussed at that time. The February 2010 letter states that a plan of development was being completed which would provide more detailed information and outline the actual acreage of ground disturbance. We have yet to see this plan. The May 12, 2011 meeting was not a representation of Government to Government consultation as non-Federally recognized tribes, non-enrolled tribal members, and Tribal monitors were also invited to the meeting. Additionally, the meeting was disrupted by constant arguments between the above mentioned parties and agencies and contractors, so that no information regarding the project was presented, and therefore no information was disseminated on the project to cultural resources staff or Tribal Governmental officials present at the meeting. 36 CFR 800.1(c) states, "The agency official shall ensure that the section 106 process is initiated early in the undertaking's planning, so that a broad range of alternatives may be considered during the planning process for the undertaking." To date, the objective of "true" consultation has not been met. The BLM ECFO has had one (1) meeting with the Cocopah Tribal Council on July 12, 2011, and this meeting was initiated by the Cocopah Tribal Council in an effort to elicit specific project information. The meeting served merely as an introduction to the project with no specific information on effects/impacts to the numerous cultural and environmental resources within the project boundaries.

EC3-01, cont.

2. Timelines and Deadlines: From its initiation, this project has been on an impractical timeline. The cultural resources survey has been rushed to the point that resources are not being properly and completely recorded or assessed. The field recording methods have been modified several times, without notification or explanation to tribes. The Draft Plan Amendment (DPA) and Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) was published in June 2011 without completion and publication of the cultural resources inventory. The comment period for the DPA-DEIS/DEIR will end on October 5, 2011. To date (8/15/11), the cultural resources inventory is yet to be completed and published for comment, which means the comment period for the DPA, DEIS/DEIR will pass without tribes having crucial information (cultural resources inventory) that is necessary for their review of the DEIS/DEIR. How can a document, designed to assess impacts to the resources within the project boundaries, be published and put out for comment when the impacts to cultural resources have not been fully addressed? Additionally, how can tribes be assured that their concerns and suggestions will be included when the process has moved forward without proper consultation and documentation of effects/impacts to the resources? 36 CFR 800.8(a)(1) states, "Agencies should consider their section 106 responsibilities as early as possible in the NEPA process, and plan their public participation, analysis, and review in such a way that they can meet the purposes and requirements of both statutes." Further, 800.8(a)(3) states: " Agency officials should ensure that preparation of an environmental assessment (EA) and finding of no significant impact (FONSI) or an EIS and record of decision (ROD) includes appropriate scoping, identification of historic properties, assessment of effects upon them, and consultation leading to resolution of any adverse effects." Obviously, the latter statement cannot be fulfilled without the completion of the

EC3-02

Cultural Resources Inventory and consultation with tribes to complete project analysis, review and mitigation of effects. We request a plan of action from BLM that will outline your efforts to insure Tribal concerns, comments, and suggestions will be solicited and incorporated into the official record, DEIS/DEIR and the cultural resources inventory.

EC3-02, cont.

3. Identification of historic properties and assessment of adverse effects: 36 CFR 800.4(b) states; Based on the information gathered under paragraph (a) of this section, and in consultation with the SHPO/THPO and any Indian tribe or Native Hawaiian organization that might attach religious and cultural significance to properties within the area of potential effects, the agency official shall take the steps necessary to identify historic properties within the area of potential effects. The tribe has been asked, by BLM, to provide information, identify areas of concern and also to suggest mitigation for the effects of the project. However, how can the tribe fulfill these requests when the extent and nature of the cultural resources, and how this project will affect those resources have not been fully assessed, documented, and provided to the tribes? We request that the Cocopah Indian Tribe be provided maps that show the location of the cultural resources within the project boundaries and their relationship to the proposed wind turbines. Further, we request a copy of the complete cultural resources inventory with National Register eligibility recommendations, and proposed mitigation measures for those historic properties that will be affected by the project within a week of receipt of this letter. 36 CFR 800.5 (2)(i-vii) lists examples of adverse effects on historic properties, these include, but are not limited to; physical destruction, alteration of property, removal of property, change of the character of the property's use, introduction of visual, atmospheric, or audible elements, neglect of property, transfer, lease or sale of property. Clearly, the proposed OWEF project will create adverse effects in several of these areas. Having said that, it would seem that it would be in BLM's best interest to provide tribes with all project information early in the process and initiate a free flowing dialogue with tribes to address all areas of concern and possible suggested mitigation of adverse effects. Additionally, we feel that BLM is neglectful of its duties concerning the protection of the several known cremation locations that have been identified. 36 CFR 800.5 (2)(vi) Neglect of property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization. The BLM has been made aware of the ongoing destruction to these locations over the past ten (10) months, however you have chosen to do nothing to protect these invaluable locations; plainly these actions, or rather lack of action, go against the regulation stated above. Again, we ask for a plan of action from BLM for the protection of these locations and the human remains found there.

EC3-03

If you have any questions or need additional information please feel free to contact the cultural resource department. We will be happy to assist you with any future concerns or questions.

Sincerely,

Dale Phillips
Vice Chairman
Cocopah Indian Tribe

Cc: Ms Carrie Simmons – Archaeologist BLM ECFO
Mr. Tom Zale – Associate Field Manager BLM ECFO
Ms Nancy Brown, - Liaison to the BLM ACHP
Mr. Dwight Dutschke California SHPO

THE COCOPAH INDIAN TRIBE

Office of the Tribal Chairwoman
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Telephone (928) 627-2102
Fax (928) 627-3173

CCR – 034-07-012

November 1, 2011

Margaret Goodro
Field Manager
El Centro Field Office
Bureau of Land Management
1661 S. 4th Street
El Centro, CA 92243

RE: Comments for the Draft Plan Amendment and DEIS/DEIR Ocotillo Wind Energy Facility (OWEF), Ocotillo, California

Dear Ms. Goodro:

Upon receiving and reviewing the Draft Plan Amendment and Draft Environmental Impact Statement/Environmental Impact Report (DPA, DEIS/DEIR) for the Ocotillo Wind Energy Facility (OWEF) project in June 2011, we would like to provide you with additional comments and concerns with this project to supplement our August 12, 2011 letter. Overall, we find the DEIS/DEIR to be insufficient and incomplete in several areas.

- Full consideration to all alternatives was not given. Both Alternatives 2 and 3 would be less environmentally and culturally invasive (both would install less wind turbine generators 137 and 105 respectively), while still providing the amount of energy, 315 MW, the applicant is subject to produce under their Power Purchase Agreement. Alternative 1 will install 155 wind turbine generators and produce 465 MW, 150 MW over the amount of their Power Purchase Agreement. Where will this extra energy go? Additionally, both the Imperial County and CEQA have chosen Alternative 1 as the preferred alternative. Why then has the Bureau of Land Management (BLM) chosen

EC4-01

EC4-01, cont.

Alternative 1, the most environmentally and culturally invasive, as the preferred alternative?

- The report fails to address cumulative and indirect impacts to the project area. The impacts to the sensitive desert landscape of the region are not fully addressed, i.e., natural washes, groundwater resources, and desert pavement, will be impacted by the grading of roads, location of towers and use of limited water resources. At this time, numerous renewable energy and transmission line projects are either proposed or in the construction phase across Southern California. However, the cumulative impacts of these actions, in conjunction with the OWEF are not fully analyzed. The Sunrise Powerlink transmission line (currently in the construction phase) is in close proximity to the OWEF and may create additional impacts to the area. Additionally, the existing Southwest Powerlink transmission line should also be analyzed for cumulative impacts. The DEIS/DEIR merely lists the existing and proposed projects in Table 4.1.1; however no discussion of the effects of these projects in conjunction with the OWEF project is analyzed. Cumulative impacts to cultural resources are not fully addressed. The construction of additional roads in this area will increase accessibility and OHV activities that currently exist and threaten the fragile resources of this area. Looting of sites could occur from these additional access routes. Environmental hazards such as flooding and sheet wash could impact sites due to the construction of WTGs in washes and the disturbance of the natural ground contours and removal of desert pavement. Also, the cultural values of the landscape and the view sheds to significant landmarks are incomplete. The Cocopah people do not segment their environment by looking only at individual aspects, but rather they see the landscape in its entirety with all aspects given equal importance and respect. The DEIS/DEIR mentions Coyote Mountain, however Mt. Signal (Little Wii Shpaa), which is an important landscape feature to the Cocopah people is mentioned nowhere in the document. The El Centro Field office of the BLM was made aware of this landmark in discussions for prior projects, but again has failed to consider it when assessing impacts from proposed projects.

EC4-02

- The impacts to plant and animal life are not fully addressed from a cultural perspective. This project will have numerous adverse impacts to these

EC4-03

resources such as loss of habitat, auditory, migratory, nesting and roosting, and the effects to nocturnal species. Many species of plants and animals are important to tribal people. Various plant species will be impacted and may become inaccessible to local tribes that utilize them for medicinal, religious and spiritual purposes. However, this fact is not identified within the document. A tribal access plan should be discussed as a mitigation measure.

EC4-03, cont.

- From its initiation, this project has been on an impractical timeline. The Draft Plan Amendment (DPA) and Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) was published in June 2011 with incomplete information for the cultural resources analysis section (Section 4.4). The comment period for the DPA-DEIS/DEIR will end on November 4, 2011. However, tribes did not receive the Draft Archaeological Survey Report until October 11, 2011 (this document was also sent out with information from several appendices missing). This hardly leaves tribes enough time to review and analyze the vast information in the archaeological survey report that should have been included in the DEIS/EIR document.

EC4-04

- Throughout this process, numerous tribes have raised objections to the project due to the vast resources found in this region, the identification of cremated remains, and the significant value of the landscape. The DEIS/DEIR fails to adequately assess the impacts of this project on these resources and the cultural value of this region to these tribes. However, nowhere in this document were these concerns addressed or resolved. Long term monitoring and management were also not discussed within this document. It seems apparent that this project, in any form, will have long lasting effects which should be addressed within this document. Given the obvious significance of this area, the BLM should take steps to nominate it as a Traditional Cultural Property (TCP). The Cocopah Indian Tribe urges the BLM to acknowledge the value of this landscape to the tribe(s) as an integral part of their history and continuing culture. Additionally, given the view sheds, cultural and environmental resources contained within the landscape, connections to oral histories, and the spiritual nature of the location to the tribe(s) we advocate for the enforcement of the American Indian Religious Freedom Act and Executive Order 13007.

EC4-05

Finally, the NEPA process cannot conclude without the completion of the Section 106 process or a process for completion such as a Programmatic Agreement or a Memorandum of Understanding has been laid out. To date, BLM has not discussed either of these alternatives with the tribe(s). We hope the BLM will give full and meaningful consideration to the issues addressed within this correspondence with open and direct consultation regarding the project's impacts. If you have any questions or need additional information please feel free to contact the Cultural Resource Department of the Cocopah Indian Tribe. We will be happy to assist you with any future concerns or questions.

EC4-06

Sincerely,

Sherry Cordova, Chairwoman
Cocopah Tribal Council

SYCUAN BAND OF THE KUMEYAAY NATION

Daniel J. Tucker
Chairman

Ricci La Rake
Vice Chairman

Candelita Billingsly
Secretary

LaShunna Davidson
Treasurer

Orlando Sandoval
Council Member

Jamie D. LaBrake
Council Member

Henry R. Murphy
Council Member

October 11, 2011

RECEIVED
BUREAU OF LAND MANAGEMENT
2011 OCT 21 PM 12:25
EL CENTRO FIELD OFFICE
EL CENTRO, CA

Bureau of Land Management
El Centro Field Office
Attn: Margaret Goodro, Field Manager
1661 S, 4th Street
El Centro, CA 92243

Re: Ocotillo Express

Dear Ms. Goodro:

We have received the Draft Archaeological Survey Report for Ocotillo Express which apparently was provided to us on October 4, 2011. However, this report was not received until Friday, October 7, 2011. While the report was available on an FTP site, many tribal representatives and staff members lacked the capabilities of accessing the report online. Those who were able to finally access the report discovered numerous references to information contained in the confidential appendices. Those appendices were not included. A request has been made for that information, and we are informed that some of the appendices have not been completed and are therefore not yet available. As a result the report provided to tribes and is an important part of our analysis of the DEIR/S is incomplete.

EC5-01

While we appreciate your willingness to extend the comment deadline to November 4, we are still forced to request an additional extension because this deadline does not take into account the internal tribal protocols and processes for reviewing and commenting on technical documents of this nature. During a meeting with tribal representatives in Palm Springs, tribal representatives explained to the BLM that these types of tim frames work untenable for tribes. When dealing with tribal cultural resources, we often must abide by certain protocols, including consultation with elders of our or other tribes and in some cases even specific ceremonies, to acquire information and the permission to share the information the BLM is seeking. The process does not lend itself to arbitrary BLM timeframes, and the continued failure of the BLM to work with tribes in establishing appropriate timeframes for these information exchanges is a continued demonstration of the BLM's inability and/or unwillingness to engage with tribes in meaningful consultation. Meaningful consultation should include sincere and open dialogue that is mindful of the tribe's needs and recognizes internal tribal protocols. Meaningful consultation is not the issuance of a demand for sensitive information to be provided within an arbitrary period of time.

EC5-02

We understand the interest in developing renewable energy projects, but we are concerned that current renewable energy proposals are being considered without a clear, well-considered strategy that was created, in part, through meaningful consultation with the tribes. The BLM as the lead agency has the authority to approve or disapprove these projects. The BLM as the lead agency and as st wards of public lands has the authority and the duty the ensure compliance with the existing legal framework in which these project applications are made, particularly where tribes and the general public have raised serious concerns. The BLM is not obligated to accept incomplete project applications, nor to approve them. The BLM is obligated to discharge consultation duties under a number of federal laws' including NHPA, regulations and executive orders and pursuant to its trust obligation as a federal agency. The BLM has not discharged its duty with regard to the Ocotillo Express project, or the Tule Wind, ECO Substation or Sunrise Powerlink projects to name a few.

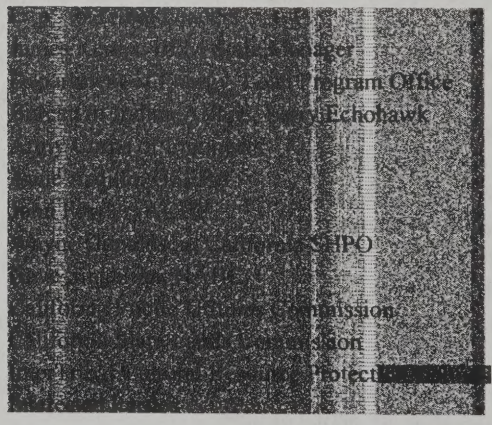
EC5-03

Again, we request that the deadline for tribal comment be extended from November 4, 2011 to after January 1, 2012. We also request a meeting to discuss our concerns about the Ocotillo Express Project. We appreciate your immediate attention to this matter.

EC5-04

Sincerely,

Daniel J. Tucker
Tribal Chairman



Comment Letter EC6a

VIEJAS
TRIBAL GOVERNMENT

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Anthony R. Pico, Chairman
Robert Cita Welch, Vice Chairman
Anita R. Uqualla, Tribal Secretary
Samuel Q. Brown, Tribal Treasurer
Greybuck S. Espinoza, Councilman
Victor E. Woods, Councilman
Raymond "Bear" Cuero, Councilman

December 9, 2011

Mr. James Kenna, State Director
Bureau of Land Management
2800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Angelina Havens, Planner, County of Imperial
801 Main Street
El Centro, CA 92243

Re: Ocotillo Wind Energy Facility DEIS/DEIR Comments

Dear Mr. Kenna and Ms. Havens:

The Viejas Band of Kumeyaay appreciates the extension of time that was provided us to comment on the Draft Environmental Impact Statement/Report (DEIS/DEIR) on the proposed Ocotillo Wind Energy Project (OWEP) and its technical appendices. This extension was made necessary by the fact that many of the documents intended to support the DEIS/R were not supplied to us until very recently, and required time for both our tribal members and our expert consultants to review them.

EC6a-01

Please accept the enclosed, which collectively represent the views of Viejas on the DEIS/DEIR as we presently understand it, though Viejas reserves the right to amend and augment its comments as more information on the project is revealed. Included in this submission are comments by Kimberly R. Mettler, General Counsel and Director of the Viejas Office of Legal Affairs; Courtney Ann Coyle, an attorney specializing in CEQA and tribal cultural resources protection; Dr. Thomas F. King, expert in cultural resource management and environmental impact assessment; Carmen Lucas, an elder and tribal cultural monitor from the Kwaaymii Band of Laguna Indians, and others experts in related disciplines. We trust that the level of expertise and attention we have brought to this matter will further underscore the serious concerns that Viejas has regarding the proposed project and significant, unmitigated impacts.

Please consider the comments by our experts as representing Viejas' observations on the DEIS/R and its supporting documents, and consider any questions to be our questions. We have consulted with each of the individuals listed, reviewed their documents, and support them. These comments are being provided to you both via email and via Fed Ex.

EC6a-01, cont.

Thank you for your attention to this matter.

Sincerely,

Anthony R. Pico, Chairman
Viejas Band of Kumeyaay Indians

CC:
Tribal Leaders
Intertribal Cultural Resources Protection Council
Margaret Goodro, BLM El Centro
Bureau of Indian Affairs
Army Corps of Engineers
Anne Ardillo, US EPA
John Fowler, ACHP
Wayne Donaldson, California SHPO
Dave Singleton, NAHC
California Public Utilities Commission
California State Lands Commission

Comment Letter EC6b

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December 9, 2011

Mr. James Kenna, State Director
Bureau of Land Management
2800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Re: Ocotillo Wind Energy Facility DEIS/DEIR Comments

Dear Mr. Kenna:

These comments on the draft environmental impact statement/draft environmental impact report (DEIS/DEIR) by the Viejas Office of Legal Affairs have been made in consultation with various departments within the Viejas Tribal Government including its public safety and land use, and its cultural resources experts and land use departments. It also references several independent consultants retained by Viejas to review the environmental documentation. Collectively these comments and all documents attached and referenced herein represent the views of the Viejas Band of Kumeyaay Indians on the DEIS/DEIR as we presently understand it, though Viejas reserves the right to amend and augment its comments as more information on the project is revealed.

The concerns expressed in this letter and its enclosures lead Viejas to support denial of the proposed project by the Bureau of Land Management (BLM), the Department of Energy (DOE), the U.S. Army Corps of Engineers and the County of Imperial. Should the project not be denied at this time based on these and other concerns, Viejas insists that a thorough, honest, and consultative review of its potential impacts be conducted and, reflected in revisions to the DEIS/DEIR, for which there should be additional opportunity for public review, comment, and consultation; we also expect full compliance with Section 106 of the National Historic Preservation Act (NHPA), the Native American Graves Protection and Repatriation Act (NAGPRA), and other relevant legal authorities, and government-to-government consultation with affected Indian tribes, prior to any agency decision to approve or disapprove the project. We expect each of the above instances, and the specific issues outlined below and in the enclosures to this letter to be responded to in writing.

EC6b-01

Responsibility for the DEIS/DEIR

It is Viejas' understanding that the DEIS/DEIR and the underlying documents on which it is based were substantially if not entirely produced by contractors for the Applicant, Pattern Energy. Please tell us whether this is true, and if it is true, please explain to us why Viejas, the BLM and its cooperating agencies, or anyone else should take this document to be an objective analysis of the proposed project's impacts, as opposed to a report designed to hide such impacts and make the project look more desirable than it really is. This point is illustrated, with two examples: one, the final paragraph of the draft archaeological report, which extols Pattern's "avoidance" of cultural resources and, two, the comments on the DEIR/EIS submitted by Dr. Jackson Underwood, the principal author of the draft archaeological report, who shames those who have not paid proper respect to Pattern for proposing this project. When biases are so obvious, how can and why should any reviewer accept what the document says as factual?

EC6b-02

Tribal Consultation:

The Tribal Consultation section implies that tribes have been consulted, but, if the experience of Viejas is any guide, this is simply not true. BLM has on occasion contacted us and asked our views, but there has been no meaningful consultation. The DEIS/DEIR fails even to discuss what consultation BLM thinks it has conducted, or what tribal concerns have been. The type of nonsubstantive summary in the DEIS/DEIR is meaningless and unhelpful to tribal leadership or others in understanding what the areas of controversy are regarding the project and what possible solutions may exist. Numerous Kumeyaay bands have expressed serious concerns about this project. Yet, the DEIS/DEIR does not convey those concerns.

It is indicative of this lack of real consultation that there has been no feedback from BLM regarding the concerns we have expressed. Viejas has submitted a number of letters including an August 31 letter as a follow-up to a meeting and requesting additional information; and letters on August 29, August 25 and July 13, yet, no responses from BLM have been forthcoming. Why is BLM ignoring tribal input? Where is the consultation on tribal concerns? It is our view that the BLM has failed to adequately or meaningfully consult with Tribes on this project. The BLM should undertake much greater effort to reach out to those tribes and engage them in this consultation process. Independent experts consulted by Viejas agree, and their opinions are part of Viejas' comment packet.

EC6b-03

Page 3.4-20: The DEIS/DEIR improperly characterizes Native Americans participating in the field surveys as consultants. These individuals are Native American monitors, who are in the field to identify individual sites of significance, to help avoid damage to artifacts and burials, and to provide information about cultural resources located within a proposed project area. To identify them as consultants improperly conveys the impression that they are official representatives of their tribal governments with whom the BLM engaged in meaningful government-to-government consultation. This, of course, is not the case. Moreover, it is notable that the information provided by these individual monitors was not even incorporated into the draft technical reports. Even a cursory review of the confidential appendices and the draft archaeological report shows that the concerns and values of those Native American monitors were consistently ignored or downplayed.

EC6b-04

3.4.20: This section states that the BLM is consulting with Tribal Governments, tribal representatives and Native American consultants to help identify places within or near the project area that have cultural or religious significance to Native Americans. This is misleading. As noted above, meaningful consultation has not occurred with regard to this project. Further, this section suggests that no information has been forthcoming from interested Native American parties, which is untrue. It has been conveyed a number of times that the entire landscape that includes the proposed project area is a cultural landscape of importance to Kumeyaay people and their tribal governments. Please see, for example, the attached Viejas Tribal Council Resolution Recognizing the Tribal Traditional Cultural Landscape in the Ocotillo Area, Resolution No. 112311B, which formalizes the many statements made by Viejas and other tribes and tribal members over the last several years regarding the proposed project area.(Tab 1). Please note, too, that even the specific concerns of tribal monitors reported in Appendix G to the DEIS/DEIR have not been addressed by BLM, and are ignored in the DEIS/DEIR itself. The unfounded assertions and vague promises contained in the DEIS/DEIR do not substitute for actual and meaningful consultation with tribal governments. EC6b-05

5.2.3 Tribal Consultation: The BLM acknowledges that they have received information indicating the significance of the area of potential effects (APE) to tribes, including that it is of religious significance and is considered a sacred site, but has done nothing to address this information. The DEIS/DEIR consistently downplays the tribal concerns about cumulative and indirect impacts. EC6b-06

Cultural Resources Section 3.4:

- The BLM intentionally misrepresents the information on page 3.4-1 "Several cultural resource studies **have been completed** in support of the EIS." As of the release date of the DEIR (and as of the announced public comment deadline), the cultural resources reports were incomplete and had not been released to the tribes despite several requests. Moreover, the incomplete draft documents we have seen do not report on comprehensive studies of "cultural resources;" they are merely reports on archaeological surveys. "Archaeological sites" as understood by archaeologists comprise one kind of cultural resource, but there are many other kinds, notably including cultural landscapes of traditional importance to Indian tribes – which are ignored by the DEIS/DEIR (See enclosed analysis by Viejas consultant Thomas F. King, hereinafter King analysis, at Tab 2 and by Viejas consultant Daniel F. McCarthy at Tab 3). EC6b-07

- This entire section references prehistoric indigenous use and occupation of the area and, despite having referenced the participation in field surveys by Native Americans who provided information, does not reference the connections of contemporary Native Americans to this area. Attached is a document provided to us by one of numerous knowledgeable and affected tribal parties, Carmen Lucas, in an effort to include this kind of information in the record since the DEIS/DEIR fails to do so.(Tab 4) We insist that this information, and other information on tribal connections to the area, be fully considered. EC6b-08

- Page 3.4-16: States that there are no sites that have been characterized as geoglyph sites. This is incorrect: the Spoke Wheel rock feature has been characterized as a geoglyph. Additionally, another geoglyph is referenced in table 3.4.3 and is the subject of discussion in the draft archaeological report. Other geoglyphs may exist; note that Appendix G documents the recommendation that aerial remote sensing be used to identify such sites, but there is no indication that this has even been considered. Such features are eligible for the National Register of Historic Places and contribute to the National Register listed thematic discontiguous district referred to as "Earth Figures of California-Arizona Colorado River Basin.". **EC6b-09**

- As stated in Viejas Resolution No. 112311B, the entire landscape within which the project is proposed is a cultural landscape of traditional cultural and spiritual significance to Kumeyaay people and the Viejas Band (Tab 1). The DEIS/DEIR, however, consistently ignores landscape values in favor of addressing only individual spots on the ground that archaeologists record as "archaeological sites" (See King analysis for discussion of this "atomizing" problem at Tab 2). Given the agencies' apparent unwillingness simply to consult with the Kumeyaay bands about the landscape and its significance, it is unclear to Viejas why the DEIS/DEIR does not contain or report analyses such as cultural landscape studies, consideration of the area as an archaeological district, assessment of the landscape as a traditional cultural property, conduct of an ethnographic study, and/or assessing the landscape's eligibility for the National Register of Historic Places as a district. If BLM is unwilling to take the word of tribes like Viejas for the landscape's significance, such studies and assessments might assist the BLM in understanding the full impact of the proposed project on tribal cultural resources. Some such studies are proposed in the DEIS/DEIR as mitigation measures, but this is wholly inappropriate. The National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA) and the National Historic Preservation Act (NHPA), among other authorities, require that the significance of potentially affected resources, including cultural resources, be ascertained prior to taking a federal action, not afterwards. To propose that learning what will be or has been destroyed after the decision is made to destroy somehow constitutes "mitigation" is illogical and contrary to law. When applied to resources of religious importance to an Indian tribe, it is also deeply offensive, insulting, and inconsistent with the federal government's trust responsibilities. **EC6b-10**

- The DEIS/DEIR and the (incomplete) draft archaeological survey report on which it is partially based evaluate the specific spots on the land that archaeologists have identified almost exclusively under National Register Criterion D (36 CFR 60.4(d)). Had Viejas been consulted, we would have made it clear that many of these properties, and the landscape that contains them, are eligible under National Register Criterion A as well, for their association with the traditional history and culture of the Kumeyaay people. **EC6b-11**

- 3.4-15 This page acknowledges that viewsheds are important to tribal use of the Spoke Wheel Geoglyph (CA-IMP-6988), but then only addresses one aspect of the viewshed: that to the east toward Coyote Mtn. What about the other parts of the viewshed? The **EC6b-12**

DEIS/DEIR also claims without any supporting data that impacts on the eastern viewshed have been "avoided," when in fact a line of turbines is proposed within one-half mile to the east of the site with several other lines beyond it. The viewshed of the other recorded geoglyph site (CA-IMP-6920) is not even discussed. This sort of casual neglect of impacts on tribal use of the cultural landscape is typical of the bias shown in the DEIS/DEIR, ascribing value only to archaeological observations and interests at the expense of tribal cultural values.

EC6b-12, cont.

- Incorrect characterization of cultural places: in the discussion on page 3.4-16 and 3.4-17 the DEIS/DEIR refers to "dance patterns" and ascribes their creation to some kind of line-dancing. First, since the technical reports were not completed at the time of release of this DEIS/DEIR, whose opinion is this? Second, it is clear that the tribal values, understanding and analysis were not applied to the interpretation of such sites. During a field visit on August 26, 2011, in 115 degree heat, we visited some of these cultural places with Quechan elders/consultants. They explained to those in attendance (which included BLM and Tierra personnel who were not listening but instead holding a separate conversation) that these weren't "dance circles;" rather, those were places of ceremony. Further, the "trails" that connect them are not trails, rather these too are ceremonial places that are related to others that run throughout the Imperial Valley. These are all related and are used or were used sequentially depending on the ceremony. They are used only for specific purposes. These are preparatory places for other ceremonies. The belief is that one does not go out to these spiritually powerful places for general purposes, and that there are things one must do spiritually in order to go to such a place and talk about it to others. If ceremonial places were mischaracterized and therefore not properly analyzed under the DEIS/DEIR, this leads to their being undervalued and not properly addressed in planning. Moreover, if such places are so blatantly and consistently mischaracterized, how can one rely on the characterization of other places in the DEIS/DEIR?

EC6b-13

- Similarly, the DEIS/DEIR characterizes the ceramic scatters as resulting from accidental breakage without links to ceremonial or burial use. This is contrary to what elders have advised us; such scatters in fact often reflect the ceremonial activities and cremation sites of our ancestors. This among other things indicates that the landscape contains far more cremation burial sites than the DEIS/DEIR acknowledges, as well as reflecting the overall cultural and spiritual significance of the landscape.

EC6b-14

- Page 3.4-20: "BLM is consulting with Tribal Governments, tribal representatives and Native American consultants to help identify places within or near the project area that have cultural or religious significance to Native Americans." As previously stated, the BLM misrepresents its "consultation" efforts; in fact, proper government-to-government consultation has not even been initiated. As also previously stated, the DEIS/DEIR seems to confuse government-to-government consultation with discussions that BLM and contractor personnel may have had with people the DEIS/DEIR characterizes as "tribal representatives" and "Native American consultants."

EC6b-15

Page 3.4-20 The BLM states that "Native Americans were invited to participate in project field surveys as tribal consultants." This is disingenuous and misrepresents the presence of Native American monitors in the field. Native American monitors, as noted above, are not "tribal consultants," and whatever discussions may have taken place between them and Pattern Energy's archaeological contractors has nothing to do with the performance of BLM's tribal consultation responsibilities. Moreover, there were not monitors with every survey team, and to judge from a comparison of Appendix G and the archaeological survey report, the expertise of the monitors in the identification and analysis of resources was minimized.

EC6b-16

- Page 3.4-53: "The BLM complies with its obligations under the NHPA through a National Programmatic Agreement and related 2007 State Protocol Agreement specific to California." Both the Programmatic Agreement and State Protocol Agreement are predicated on BLM's assurance that proper tribal consultation will take place; such consultation has not occurred. As we understand the State Protocol Agreement, the BLM is required to initiate consultation with the State Historic Preservation Officer (SHPO), tribes, the Advisory Council on Historic Preservation (ACHP) and other interested parties in accordance with the NHPA Section 106 regulations (36 CFR 800) if it is determined that an adverse effect on historic properties will take place. Despite all the DEIS/DEIR's efforts to undervalue and ignore the significance of the cultural landscape, and to claim that impacts have been "avoided" by not proposing to locate wind turbines on spots that archaeologists identify as significant, BLM is unable to pretend that adverse effects will not occur, and it is our understanding that BLM has sought to initiate consultation with the SHPO (without involving Viejas or, as far as we know, other tribes). Thus, in this case BLM cannot "comply with its obligations under the NHPA" through use of the Programmatic Agreement and State Protocol Agreement. It it must follow 36 CFR 800 and (a) consult with tribes, the SHPO, the ACHP and other interested parties; (b) in consultation with such parties, make a reasonable and good faith effort to identify historic properties (of all kinds, not just those spots on the ground valued by archaeologists); (c) in consultation, evaluate such properties with reference to the National Register Criteria (36 CFR 60.4(a) through (d); (d) in consultation, determine what direct and indirect effects the proposed project may have on eligible properties, and what contributions it may make to cumulative effects on them, (e) in consultation, seek ways to resolve adverse effects, and (f) either conclude a memorandum of agreement (MOA) or programmatic agreement (PA) on how such effects will be resolved, or ask the ACHP to render a comment to the responsible agencies (in this case the Secretary of the Interior, and probably the Secretaries of Energy and Defense), who must address the comment in making a final decision on the project.

  Viejas has serious concerns about how the agencies propose to comply with Sections 106, 110(a), and 101(d)(6) of NHPA. We also remind the agencies that Section 106 must be complied with prior to any decisions about whether to approve the proposed project.

EC6b-17

- 3.4-53: American Indian Religious Freedom Act (AIRFA): "The BLM complies with AIRFA by obtaining and considering the views of traditional religious practitioners as part

EC6b-18

of the NEPA compliance process." There is no evidence in the DEIS/DEIR that the BLM has obtained and considered such views in this regard. In fact, a review of the confidential consultation report, the appendices and the draft archaeological report makes it clear that the views of tribal religious practitioners, elders, culture keepers, etc., were *not* considered.

EC6b-18, cont.

- 3.4-53: Executive Order 13007: BLM said that it complies with the E.O. by consulting with tribal governments and religious practitioners. This is a misstatement of the E.O. provisions which require: 1) accommodation of access to and ceremonial use of sacred sites and 2) *avoidance of adverse affects to the physical integrity of such sacred sites.* It is clear from the information in the Viejas submission and elsewhere that these two E.O. provisions are not achieved with the BLM preferred alternative or the other two onsite build alternatives. Consultation with appropriate parties is a procedure under the E.O., but does not by itself satisfy its substantive requirements. In any event, consultation with tribal governments and religious practitioners has not yet even been initiated.

EC6b-19

- Section 3.4-55 discussion about the Imperial Valley General Plan Goal 9 (Protection of Environmental Resources) and Goal 3 (Protection of Cultural Resources): The BLM says: "As currently designed, the proposed project is consistent with Goal 9 and Goal 3." However, it doesn't explain how it is consistent with these goals, nor which alternative meets these goals. Further, it would seem that in fact all alternatives except for the no build alternatives are inconsistent with both Goal 9 and Goal 3, particularly since Goal 3 is intended to preserve "important prehistoric and historic resources to advance scientific knowledge *and maintain the traditional historic element of the Imperial Valley landscape."* (Emphasis added).

EC6b-20

Furthermore, certain programs are provided by Imperial County under their General Plan—BLM says, among other things, that under one of these programs all information and artifactual resources recovered in this process will be stored in an appropriate institution and made available for public exhibit and scientific review; and Imperial County will "discourage vandalism of cultural resources and excavation by persons other than qualified archaeologists and will study the feasibility of implementing policies and enacting ordinances toward the protection of cultural resources." There has been no known consultation on this matter, no assurances or clear process as to how this will occur. In fact, curation, display and interpretation may be an acceptable archaeological mitigation measure, but given that this area is one of ceremony, such measures may not be culturally-appropriate and may be spiritual violation. Note in Table 3.4-5 it says that Imperial County will use the environmental impact report process to conserve cultural resources. What has Imperial County done with regard to the environmental analysis as it is not reflected in the DEIS/R?

EC6b-21

The California Desert Conservation Plan Amendment:

The DEIR/EIS does not include any analysis or take into consideration other amendments that may be under consideration as a result of other project applications or the proposed Desert Renewable Energy Conservation Plan (DRECP), which is in its planning stages. How can impacts be adequately identified or determined when other conservation plans are being considered or proposed? EC6b-22

Environmental Justice:

This section is inadequate as it excludes any analysis relevant to the Native Americans who have significant cultural and religious attachments to the area. The project, if approved, would negatively impact valuable cultural resources, spiritual practices, and sacred sites, and constitute a disproportionate adverse environmental impact on Viejas. This certainly is an environmental justice issue. EC6b-23

Lands and Realty:

This section lacks any reference to, or analysis of impacts to special land use areas in close proximity to the APE, including Anza Borrego Desert State Park (ABDSP), the adjacent Cultural Preserves within ABDSP, designated wilderness, the National Forest, or any of the existing nearby Areas of Critical Environmental Concern (ACECs).

This section also describes a portion of the Imperial County Land Use ordinance that prohibits structures from exceeding 80 feet, except for communications towers (100 feet). Will variances be sought from this Ordinance? If so, why aren't the proposed findings for this and the required Conditional Use Permit part of the DEIS/DEIR? (Please see the attached letter from Attorney Courtney Ann Coyle, which outlines how the County cannot substantiate the required findings for either). EC6b-24

Wind Sufficiency:

A recent study by an Ocotillo resident indicates that there is insufficient wind in the Ocotillo area to support the proposed project. We are aware that the project Applicant, which collected wind data from MET towers in the area, believes that such data support the viability of the project, but the Applicant takes the position that such data are proprietary in nature and refuses to release the information for review. This makes it impossible for anyone to assess whether the project will really address its presumed (but never clearly articulated) purpose and need, or whether it is merely a ploy on the Applicant's part to obtain federal financial assistance for a project of marginal feasibility and utility. We believe this wind study raises serious and legitimate concerns about this project's feasibility, and that the information supports both the release of the Applicant's information (unredacted) for review and analysis by independent experts and the commissioning of a new wind resource study of the actual proposed project area. EC6b-25

Biological Resources:

- The biological reports lack a tribal (cultural) component and the archaeological surveys lack any discussion of the significance of animals and plants to the Native peoples or as EC6b-26

part of the cultural landscape. Noted in the technical reports are a number of species including the burrowing owl, five bat species, red-tailed hawks (abundant population); northern harrier, kestrels, ferruginous hawk, and other sensitive bird species. The report also notes the flat-tailed horned lizard, the rosy boa, barefoot band gecko and the peninsular bighorn sheep are present. Golden Eagles, like other wildlife and plant species in the project area, are important biological resources that also have significant cultural resource value to tribal people. These cultural resource values have not been considered in the DEIS/DEIR. Moreover, no consultation has occurred with regard to any protection or mitigation plan of animals that may be of significance to the tribes, including the golden eagle, the bighorn sheep, and the flat-tailed lizard.

EC6b-26, cont.

- Wind turbines are known to be a cause of death for migratory birds. We are concerned that this project will have adverse affects on migratory birds, including eagles, which are of cultural significance to us. The technical report identifies 5 golden eagle territories in the survey area. The report also notes that drought and disturbance by off-road vehicle activity are the primary factors in the inactivity of one of the areas. The BLM is charged with management of this area and clearly off-road access has had an impact on the eagles. If the eagles return to the area they will be impacted by the project, and the project may keep the eagles from returning or breeding. What studies relating to the impacts of the wind turbines on eagle behavior other than collisions have been done?

EC6b-27

- The proposed project will likely have an adverse impact to bats. A number of studies indicate that bats are killed by the turbines, not through collision, but as a result of a change in air pressure that causes internal lung hemorrhaging. In fact, these studies indicate that bats have a higher mortality rate than even migratory birds as a result of wind turbines. No analysis exists of this impact, nor of the impact of these mortalities on the bat populations. There is no mention that lighting on or around the turbines may attract bats in greater numbers than were noted during the biological surveys. Given the number of bat species in the area, this must be addressed.

EC6b-28

- No analysis is included in the DEIS/DEIR about the effect of radar on the bird species in the area. There also needs to be a more comprehensive analysis of the impacts to Golden Eagles in the project area. The Helix Biological Technical Report (page 43) notes that a false conclusion may be drawn about eagles in the area without an understanding of the effect of drought on golden eagle breeding. Additionally, the surveys were done at a time where there could be no opportunity to get a complete count of the golden eagle pairs attempting to build nests and reproduce. The biological report states that the number of active territorial pairs in the survey area could be higher than those actually identified. This issue must be addressed.

EC6b-29

- Peninsular bighorn sheep are known to be in the Coyote Mountains, the Volcanic Hills and the Jacumba Mountains, all immediately adjacent to the proposed project area. It is difficult to tell from the information in the appendices, but it is possible that lambing areas occur within the proposed project area and may be directly impacted by turbine locations. Bighorn sheep are also culturally-significant to local tribes.

EC6b-30

- There is inadequate analysis of the impact of this proposed project with regard to such sensitive species and species of special concern including the burrowing owl, long-eared owl, Vaux's swift, peregrine falcon, flat-tailed horned lizard, barefoot gecko, red diamond rattlesnake, American badger, and certain plant species such as the *Pilostyles thurveri, Pholismi* sp., *Xylorhiza orcutti,* and *Astragalus crotalariae.* (Please see the attached letter report from Jon Rebman, Curator of Botany, San Diego Natural History Museum regarding additional deficiencies in the project's botanical studies at Tab 5). **EC6b-31**

- There is no analysis of the detrimental impact the construction of this wind project may have on animals using the area (even if they are small populations) for foraging. If they lose a foraging area, how will that impact them since they will have to travel greater distances for food and water (if any such locations can be found)? **EC6b-32**

Visual and Aesthetics

The DEIS/DEIR did not include any analysis of observation points within the proposed object area in proximity to the Spoke Wheel Geoglyph, which is on the National Register of Historic Places with specific reference to its viewshed, and there is no analysis of visual effects with reference to any other part of the cultural landscape – even those specific sites identified as significant by Native American monitors. Additional analysis of impacts to cultural resources, including the cultural landscape, should include observation points within the project area that are identified in consultation with affected Native American tribes. **EC6b-33**

Viejas is also concerned about other observation points within and toward the ABDSP, including its cultural preserves, that were not studied. It is our opinion that the key observation points requested by other agencies should be analyzed for the full extent of the project's impacts to visual and aesthetic resources to be disclosed. Viejas has many shared concerns with California Department of State Parks, including unacceptable visual impacts. **EC6b-34**

What is the lighting plan for the project? Will there be facility or roadway lighting? Will the 450 foot turbines have red or other lighting at the top? Would such lighting flash or blink? It is Viejas' opinion that such lighting will have adverse impacts on the dark night skies in this area. **EC6b-35**

Paleontological Resources

- Technical reports relating to the paleontological surveys are not available for review but should be. **EC6b-36**

- The assumption that the surface geology and geographic distribution of geologic units is the same as what will be encountered subsurface during construction does not have a basis is any published or cited materials relating to the Salton Trough area. The Salton Trough Quaternary Alluvium has not been excavated under paleontological study, and therefore the depths of contacting buried paleontological resources is unknown. **EC6b-37**

- Contrary to the statement in 4.10.11, damage caused to paleontological resources by construction equipment cannot be repaired in a laboratory. Additionally, training construction personnel to identify paleontological resources is not accepted mitigation. A professional paleontologist should be on site to monitor construction activities. **EC6b-38**

- Construction of access roads permanently changes the landscape and cannot be removed when the project is decommissioned. The roads will provide increased access to paleontological resources and damage to those resources can be caused by increased erosion due to ground surface activities. **EC6b-39**

Public Health and Safety

- No analysis has been done to address the change in air pressure from the wind turbines or the change in the electricity in the air from the wind turbines and how those changes will impact the biological resources in the area. There is no information about "stray voltage" which has been documented to occur near or at wind turbine sites. **EC6b-40**

- What flood studies have been done in this area to determine the impacts of flooding or major storm events on the project area? **EC6b-41**

- There does not appear to be any information addressing the effects of wind turbines on communications and aviation radar systems. This is of concern given the relative proximity of this project to the border and to El Centro and Yuma military operations. There is no analysis about how po int-to-point microwaves, wireless communication networks, and microwave communication systems (including cellular cell-site interconnections) will be impacted by wind turbines chopping and reflecting microwave beams. **EC6b-42**

- Page 4.11-2: Discusses how aircraft operations would be affected by the project, but fails to include analysis of limitations on aircraft fire suppression or the ability to conduct search and rescue operations with aircraft. **EC6b-43**

- Page 4.11-3: Excludes analysis of the impairment of use of aircraft for fire suppression, search and rescue or evacuation. **EC6b-44**

- 4.11-8: Identifies blasting/use of explosives on the construction site as the only source of wildfire ignition. There are other sources that must be studied including the use of vehicles, welding or grinding equipment and lightning. **EC6b-45**

- 4.11-9: The emergency response analysis does not take into account any consideration of a broader range of EMS response needs. **EC6b-46**

- 4.11-10: Discusses safety hazards to aircraft operations, but again does not include any obvious consideration or analysis with regard to the impact on wildland fire suppression, search and rescue or evacuation. **EC6b-47**

- No worker or visitor safety plan has been offered or analyzed which should include evacuation plans, response plans to severe weather such as lightning, flashflood, sandstorms and high wind events. **EC6b-48**

- This section is void of any mention for stray voltage, which has been an ongoing concern for communities near other operating windfarms. **EC6b-49**

- The Viejas Fire Chief disagrees with the statement in 4.11-32 that there are no cumulative impacts with regard to emergency response. There would be cumulative impacts to emergency services having to provide service to a broader area. These have not been adequately analyzed in the DEIS/DEIR. **EC6b-50**

Purpose and Need/Alternatives

Perhaps the most fundamental flaw in this deeply flawed DEIS/DEIR is its overly-narrow statement of the purpose of and need for the project, which leads to an overly narrow consideration of alternatives. This in turn causes BLM and its cooperating agencies to reject without consideration alternatives that would avoid destructive effects to Viejas' cultural landscape. Please see the King analysis enclosed for details (Tab 2).

To augment Dr. King's analysis, Viejas asked three well known experts on NEPA – Ray Clark, Charles Eccleston, and Owen Schmidt – to review Chapters 1 and 2 of the DEIS/DEIR and provide to Viejas their objective opinions as to 1) whether the purpose of and need for the project were properly formulated, and 2) whether a reasonable range of alternatives was examined. Their analysis and opinions are enclosed and incorporated as Viejas' comments at Tab 6). **EC6b-51**

In summary, from their different perspectives Messrs. Clark, Eccleston, and Schmidt, like Dr. King and Viejas, all view the purpose of and need for the project as ill-formulated, unclear, and too narrow, and the resulting range of alternatives examined as too limited. From the perspective of Viejas, this has resulted in an analysis that pre-judges the project as one that must be approved regardless of its impacts, because there is no other way to achieve the ambiguously stated purpose or meet the ambiguously stated need.

We suggest that if the real purpose of the project is to produce clean and renewable energy from domestic sources, there may be many alternative ways to achieve this purpose, and to meet the need for such energy, that might be less costly and more effective than the proposed project, that could be brought on line faster, and that would not sacrifice the cultural landscape that is of such cultural and spiritual significance to Viejas and other Kumeyaay bands and may better protect the sensitive environmental values on these public lands designated for conservation. **EC6b-52**

Conclusion:

By failing to consider such alternatives, and by producing a document with all the flaws identified above and in the enclosures to this letter, BLM, its cooperating agencies, and Imperial County have failed to meet their responsibilities under NEPA, CEQA, NHPA, AIRFA, EO 13007 and other legal authorities. By failing to consult effectively with Viejas and other affected tribes, the federal agencies have also failed to respect the U.S. government's unique relationship with Indian tribes, as articulated in Executive Order 13175, President Obama's November 5, 2009 memorandum on tribal consultation, the Department of Interior's Tribal Consultation Policy and with BLM's own internal relevant policies as outlined in the December 2005 Record of Decision (ROD) on "Implementation of a Wind Energy Program and Associated Land Use Plan Amendments" (http://windeis.anl.gov/documents/docs/WindPEISROD.pdf). EC6b-53

In its announcement of support for the United Nations Declaration on the Rights of Indigenous Peoples, the U.S. State Department asserted that "the United States is committed to serving as a model in the international community for promoting and protecting the collective rights of indigenous peoples," and that it intends to "consult and cooperate in good faith with federally recognized tribes." It would hardly be a "model" promotion and protection of tribal rights for the BLM and cooperating federal agencies to approve a project like this one, which will have devastating effects on a landscape of great cultural and religious importance to Kumeyaay people, and to do so based on a faulty, flawed analysis performed by agents of the project proponent. Failing to initiate consultation with tribes is hardly indicative of good faith on the part of the United States government. We call on you to either deny this project without further consideration, or to undertake a serious effort, in consultation with Viejas and other tribes, to correct the DEIS/DEIR's many deficiencies and perform an objective and responsible review of this project's effects. EC6b-54

If you have any questions regarding these comments, please contact me at 619-659-1710 or via email at kmettler@viejas-nsn.gov. Please include Viejas on all project mailings, hearing notices and for distribution of any other environmental documents or project findings. We look forward to your responses to the above comments, and to those enclosed.

Sincerely,

Kimberly R. Mettler
General Counsel and Director
Viejas Office of Legal Affairs
Viejas Band of Kumeyaay Indians.

Comment Letter EC6c

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Victor E. Woods, Councilman
Raymond "Bear" Cuero, Councilman

VIEJAS TRIBAL COUNCIL RESOLUTION RECOGNIZING THE TRIBAL TRADITIONAL CULTURAL LANDSCAPE IN THE OCOTILLO AREA; NOVEMBER 23, 2011

RESOLUTION NO. 112311B

WHEREAS the Viejas Band of Kumeyaay Indians, (appearing in the U.S. Federal Register at Vol. 74, No. 153, p. 40218 as the *Viejas (Baron Long) Group of the Capitan Grande Band of Mission Indians of the Viejas Reservation, California*) is a sovereign federally-recognized Indian tribe entitled to government-to-government relations with United States government (the "federal government"; and

WHEREAS the federal government, including all of its agencies, has a trust responsibility to consult in good faith with Viejas and to manage tribal lands and tribal cultural and natural resources, including tangible and intangible cultural resources valued by Viejas wherever such resources may occur, in a manner responsive to the interests of Viejas and its members; and

WHEREAS the cultural values and spiritual beliefs of Viejas are intimately related to its ancestral lands, to natural places on such lands, and to the plants, animals, and spiritual qualities of such lands; and

WHEREAS the federal government has created a system for addressing the impacts of its actions on land-related cultural values that is built around the eligibility of lands, water bodies, and other places for the National Register of Historic Places; and

WHEREAS the regulations governing the National Register of Historic Places (36 CFR 60) were developed by the U.S. National Park Service without consulting Indian tribes, and without evident consideration for tribal concerns; and

WHEREAS the U.S. Congress added Sections 101(d)(6)(a) and (b) to the National Historic Preservation Act in 1992, reminding federal agencies that places of religious and cultural importance to tribes could be eligible for the National Register and directing agencies to consult with tribes about the impacts of their actions and decisions on such places; and

WHEREAS the U.S. Bureau of Land Management (the BLM), is now considering permitting construction of the Ocotillo Wind Energy Project (OWEP), which will, if built, occupy and affect culturally and spiritually significant lands of the Kumeyaay; and

WHEREAS Viejas has continuing cultural and religious associations with the lands subject to effect by the OWEP, including their natural and cultural features, their plants and animals, the ancestral human remains interred therein, and the vistas across the valley and into the surrounding foothills and mountains.

NOW, THEREFORE, BE IT RESOLVED THAT the Viejas Band hereby affirms that the land within the eastern part of San Diego County and western part of Imperial County (as conceptually shown on the attachment entitled "Attachment to Viejas Resolution 112311B Tribal Traditional Cultural Landscape in the Ocotillo Area) comprises a landscape that is historically, culturally, religiously and spiritually important to Viejas and its members.

ADDITIONALLY, VIEJAS FURTHER AFFIRMS and hereby formally notifies the BLM that

1. The above-referenced landscape is a Traditional Cultural Property that is eligible for the National Register of Historic Places; and
2. The above-referenced landscape comprises an Indian Sacred Site as that term is defined under Executive Order 13007; and
3. That the significance of this landscape, and the impacts of the proposed OWEP on this landscape, have not been adequately addressed, and indeed have scarcely been addressed at all, by the project proponent, BLM and the County of Imperial.

BE IT FURTHER RESOLVED THAT Viejas insists that all agencies of the Federal and California state government accept and respect the above affirmations and declarations and respect Viejas' rights and interests in this landscape and the values ascribed by Viejas to such landscape.

BE IT FURTHER RESOLVED THAT Viejas also insists that all agencies of the federal government engage in good faith, meaningful consultation with Viejas under Sections 101(d)(6)(B), 106, and 110 of the National Historic Preservation Act, the American Indian Religious Freedom Act, the Religious Freedom Restoration Act, the Native American Graves Protection and Repatriation Act, and Executive Orders 13007 and 13175, and the Presidential Memorandum of November 5, 2009, and all regulations and statutes regarding confidentiality of information related to sacred places and archaeological sites, as well as pursuant to the federal government's trust responsibility toward Viejas, and that all such agencies seek agreement with Viejas concerning:

1. The direct and indirect effects of the proposed OWEP on the above-referenced landscape and on Viejas' cultural and spiritual values attached to it; and
2. The cumulative effects of Ocotillo Express and other existing, proposed and potential renewable energy projects on the above-referenced landscape and other areas of cultural and spiritual significance to Viejas; and
3. Alternatives to OWEP that may achieve the OWEP's public policy goals without adversely affecting the above-referenced landscape and the interests of Viejas therein; and
4. Other measures to avoid, reduce, compensate for, or otherwise mitigate the adverse effects OWEP, if constructed, will have on Viejas' cultural and spiritual values and interests.

BE IT FINALLY RESOLVED THAT the Viejas Band further insists that agencies of the federal government as well as state and local agencies consult and work with Viejas at all steps in their project, planning, and policy development activities, and refrain from imposing regulatory or other standards and burdens on Viejas, or on their consultation with Viejas, to whose imposition Viejas has not explicitly acceded, except where such standards or burdens are explicitly enacted by the United States Congress. This includes that Viejas not be forced to try and explain its cultural values in archaeological terms.

Resolution No.: 112311B
Tribal Cultural Landscape in the Ocotillo Area

CERTIFICATION

By signature below, we hereby certify the above-referenced vote of the Tribal Council of the Viejas Band of Kumeyaay Indians. This resolution passed this 23 day of November, 2011, at a duly noticed meeting of the Viejas Tribal Council by a vote of 5 in favor, 0 against, and 0 abstaining.

absent
Anthony R. Pico, Chairman

absent
Robert Cita Welch, Vice-Chairman

Anita Uqualla, Secretary

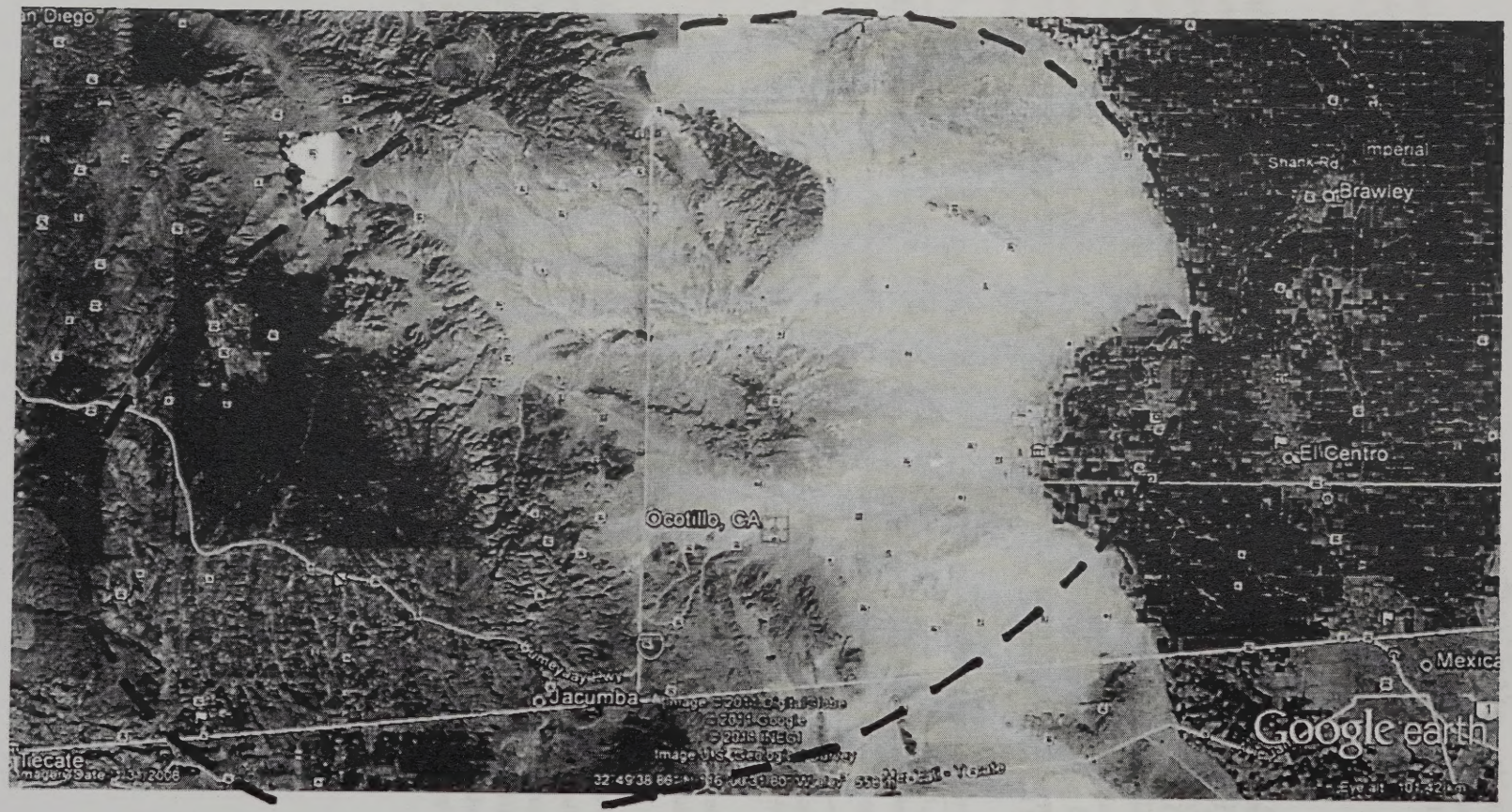
Sam Q. Brown, Treasurer

Greybuck S. Espinoza, Councilman

Victor Woods, Councilman

Raymond "Bear" Cuero, Councilman

Title: Tribal Traditional Cultural Landscape in the Ocotillo Area: Conceptual Representation, Attachment to Viejas Resolution - Tribal Traditional Cultural Property in the Ocotillo Area, November, 2011.



Disclaimer: This graphic is property of Viejas. It is considered confidential information by Viejas and is intended for use by recipient only for the purposes agreed upon by Viejas. Reference to this graphic is no substitute for government-to-government consultation on any project, plan or action. Do not reproduce, publish, alter or distribute this graphic without prior written permission from Viejas. Data and information represented on this graphic is subject to change without notice and may not be complete or appropriate for all purposes. Viejas should be consulted for the most current information. The graphic may not be to scale and is for relative location purposes only.

Note: The assignment of precise boundaries to places of spiritual and cultural significance is alien to Kumeyaay traditional thinking; in no way should the line drawn around this conceptual area on this map be taken to be a hard and fast boundary encompassing

TAB 2

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Cultural Resource Impact Assessment and Negotiation, Writing, Training

Employment

Presently: Private consultant, educator, writer, facilitator in cultural resource management and environmental review; Archeologist, The International Group for Historic Aircraft Recovery Amelia Earhart Project.

Formerly: Member, Sussex Archaeological Executive, advising the Government of Great Britain regarding archaeological recovery of site thought to be *Sussex* shipwreck off Gibraltar. Trainer/Consultant, SWCA Environmental Consultants. Senior Instructional Consultant, National Preservation Institute. Expert consultant to U.S. General Services Administration, program director for Advisory Council on Historic Preservation, Consultant to the High Commissioner, Trust Territory of the Pacific Islands, Archeologist with the National Park Service, consulting archeologist, head of archeological surveys at San Francisco State University, UCLA, University of California Riverside.

Education

PhD, University of California, Riverside, Anthropology, 1976.
BA, San Francisco State University (then College), Anthropology, 1968.
Certificate: Mediator, Bowie State University Center for Alternative Dispute Resolution, 1997.

Recent and current Clients

Government Agencies: U.S. Department of Veterans Affairs; U.S. Bureau of Reclamation; U.S. Bureau of Land Management; USDA Forest Service; USDA Farm Service Agency; U.S. Fish and Wildlife Service; U.S. Navy; U.S. Air Force; U.S. Army; Federal Aviation Administration; Grand Canyon Monitoring and Research Center; Yap State Historic Preservation Officer; Guam Historic Preservation Officer; City of Newport News, Virginia; City of Hingham, Massachusetts.

Indian Tribes & Other Indigenous Groups: Fort Mojave Indian Tribe; Table Mountain Rancheria; Pechanga Band of Luiseño Indians; Big Pine Band of Paiute; Tuolumne Rancheria; Confederated Tribes of the Umatilla Reservation; Klamath River Intertribal Fish and Water Commission; Office of Hawaiian Affairs; Mole Lake Sokaogon Community of Lake Superior Chippewa Indians; Bad River and Red Cliff Bands of Lake Superior Tribe of Chippewa Indians; Hualapai Tribe; Quechan Indian Nation; Round Valley Indian Tribes; Penobscot Tribe.

Private Sector: Blythe Energy Corp; Cingular Wireless; Odyssey Marine Exploration; Avista Utilities; Dripping Springs Ranch.

Non-profit organizations: National Preservation Institute; Buckland Preservation Society; Backcountry Horsemen of California.

Courses Taught

Short courses for SWCA Environmental Consultants, National Preservation Institute, University of Nevada, Reno, General Services Administration, Advisory Council on Historic Preservation, Environmental Protection Agency, National Park Service, and Department of Defense in cultural resource law and policy, Section 106 review, National Environmental Policy Act implementation, identification and protection of traditional cultural properties, Native American consultation, environmental justice, conflict resolution, and related subjects.

Publications (Selected)

Books and Monographs

- *Companion to Cultural Resource Management* (Editor). Wiley-Blackwell, 2011
- *Thirteen Bones* (Novel). Dog-Ear Press, 2009.
- *Our Unprotected Heritage: Whitewashing Destruction of Our Natural and Cultural Environment.* Left Coast Press, 2009.
- *Cultural Resource Laws and Practice: An Introductory Guide* (Third edition) AltaMira Press 2008 (First edition 1998; second edition 2004)
- *Saving Places that Matter: A Citizens Guide to the National Historic Preservation Act.* Left Coast Press 2007.
- *The Archaeological Survey Manual.* With Greg White. Left Coast Press 2006.
- *Doing Archaeology: a Cultural Resource Management Perspective.* Left Coast Press 2005.
- *Amelia Earhart's Shoes.* With R. Jacobson, K. Burns, and K. Spading. AltaMira Press, 2004 (First edition 2001).
- *Places that Count: Traditional Cultural Properties in Cultural Resource Management.* AltaMira Press 2003
- *Thinking About Cultural Resource Management: Essays From the Edge.* AltaMira Press 2002.
- *Federal Projects and Historic Places: the Section 106 Process.* AltaMira Press, 2000
- *Piseken Nóómw Nóón Tonaachaw: Archeology in the Tonaachaw Historic District, Moen Island, Truk.* With P.L. Parker, Southern Illinois University, Carbondale and Micronesian Archeological Survey, Saipan 1984.

Articles

- Archaeology of the Recent Past; The Legal Mélange; and A Future for Cultural Resource Management? Chapters in *Companion to Cultural Resource Management,* Wiley-Blackwell, 2011.
- Preservation, Sustainability, and Environmental Impact Assessment in Post-Colonial Developing Nations. In *Sustainability and Historic Preservation,* Richard Longstreth, editor. University of Delaware Press, Newark, 2011.
- Estudo de impacto ambiental, gestão de patrimônio cultural e bens históricos. Aprendendo com os erros dos Estados Unidos da América. Trans. By Rafael Brandi. *Cadernos de Ciências Humanas* 11 e 12, Números 20 e 21, 2008-2009 (2010); Universidade Estadual de Santa Cruz, Ilhéus-Bahia, Brasil
- Review of *Managing Archaeological Resources* (Left Coast, 2009). *Australian Archaeology* 71:84-5.

Articles (continued)

- "What Burdens Religion? Musings on Two Recent Cases Interpreting the Religious Freedom Restoration Act (RFRA)." *Great Plains Natural Resources Journal* 13:1-11.
- "A Listless Approach to Resource Management." *Heritage Management* 3:1:97-100, 2010.
- "My Historic Environment." *Historic Environment* 1:1:103-6, Maney & Son, London, 2010.
- "Backing Into Disaster: Lessons in Cultural Resource Management from the 'Graving Dock' at Port Angeles, Washington." *Journal of Northwest Anthropology* 4(2):153-161, 2009.
- "Who Makes It Heritage?" *Heritage Management* 1:1:99-107, 2009.
- "Rethinking Traditional Cultural Properties?" *George Wright Forum* 26:1:28-36, 2009, George Wright Society, Washington DC.
- Review of *Archaeological Theory and the Politics of Cultural Heritage*, Laurajane Smith, *Australian Archaeology* 66:77-8. June 2008.
- Entries on archaeological ethics, archaeology in environmental impact analysis, and deep-ocean archaeology in *The Encyclopedia of Archaeology*, Deborah M. Pearsall, ed. in chief, Elsevier, New York, 2007.
- Review of *Yearbook of Cultural Property Law: 2006*, Sherry Hutt et al, eds., *The Public Historian* 29:2:109-113, 2007
- Review of *Ethnographies of Archaeological Practice: Cultural Encounters, Material Transformations*, Matt Edgeworth, ed.; *The Applied Anthropologist* 27:2:186-8, 2007
- "Creatures and Culture: Some Implications of Dugong v. Rumsfeld." *International Journal of Cultural Property* 2006
- "Animals and the National Register." *The Applied Anthropologist* 2006.
- "How Micronesia Changed the U.S. Historic Preservation Program, and the Importance of Keeping It From Changing Back." ." *Micronesian Journal of the Humanities and Social Sciences* 5:1, 2006 (online journal, http://marshall.csu.edu.au/MJHSS/).
- "TIGHAR and the TBD in Jaluit: An Example of the Complexities to be Considered in Planning Submerged Historic Aircraft Recovery." *Micronesian Journal of the Humanities and Social Sciences* 5:1, 2006 (online journal, http://marshall.csu.edu.au/MJHSS/)
- "Cultural Heritage Preservation and the Legal System with Specific Reference to Landscapes." Chapter 13 in *Landscapes Under Pressure: Theory and Practice of Cultural Heritage Research and Preservation*, Ludomir R. Lozny, ed., Springer, New York, 2006.
- "What Are Traditional Cultural Properties? *The Applied Anthropologist* 25:2:125-130, 2005.
- Review of "Tribal Cultural Resource Management: The Full Circle to Stewardship," by Darby C. Stapp and Michael S. Burney. *High Plains Applied Anthropologist* 25:1:S:05:68, 2005.
- An Archaeological Reconnaissance of McKean Island, Phoenix Group, Kiribati, TIGHAR, http://tighar.org/wiki/McKean_Island, 2004
- Counterpoint to review: "Four Books by Thomas F. King: a Joint Review," *High Plains Applied Anthropologist* 25:S:04:201, 2004.
- Considering the Cultural Importance of Natural Landscapes in NEPA Review: The *Mushgigagamongsebe* Example. *Environmental Practice* 5:4, Oxford University Press, 2003

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- "I Learned Archaeology From Amelia Earhart: Using a Famous Mystery to Teach Scientific Methods." In *Strategies for Teaching Anthropology*, 3rd Edition, Patricia Rice and David McCurdy, eds., Prentice Hall, New York; 2003..
- "Cultural Resources in an Environmental Assessment Under NEPA." *Environmental Practice* 4(3):137-144, National Association of Environmental Professionals, Sept. 2002.
- "Historic Preservation Laws" in *Encyclopedia of Life Support Systems*. EOLSS Publishers for UNESCO, 2002.
- "What Should Be the 'Cultural Resources' Element of an Environmental Impact Assessment?" *Environmental Impact Assessment Review* 20(2000):5-30, 2000.
- "Archaeology in the Search for Amelia Earhart." With Richard Gillespie. In *Lessons from the Past: An Introductory Reader in Archaeology*, Kenneth L. Felder, ed., Mayview Press, Mountain View CA, 1999
- "How the Archeologists Stole Culture: a Gap in American Environmental Impact Assessment and What to Do About It." *Environmental Impact Assessment Review* 18(2): 117-133, January 1998.
- "The Nature and Scope of the Pothunting Problem." In *Protecting the Past: Readings in Archaeological Resource Management*. J.E. Ehrenhard and G.S. Smith, eds., The Telford Press, Caldwell NJ 1991.
- "AIRFA and Section 106: Pragmatic Relationships." In *Preservation on the Reservation*, A. Kiesert and A. Downer, eds., Navajo Nation Publications in Anthropology 26, Window Rock 1991.
- "Prehistory and Beyond: The Place of Archeology" In *The American Mosaic: Preserving a Nation's Heritage*. R.E. Stipe and A.J. Lee, eds., US/ICOMOS, Washington DC, 1987.
- "Intercultural Mediation at Truk International Airport." With P.L. Parker. In *Anthropological Praxis: Translating Knowledge Into Action*. R.W. Wulff and S.J. Fiske, eds., Washington Association of Professional Anthropologists, Westview Press, Boulder 1987.
- "The Once and Future Drought." *American Archeology* 5:3:224-8, Ridgefield, CT 1985
- "Professional Responsibility in Public Archeology." *Annual Review of Anthropology* 12, Palo Alto 1983.
- "Recent and Current Archeological Research on Moen Island, Truk." With P.L. Parker. *Asian Perspectives* xxiv(1):11-26, Honolulu 1981.
- "The NART: A Plan to Direct Archeology Toward More Relevant Goals in Modern Life." *Early Man*, Evanston, winter 1981.
- "Don t That Beat the Band? Nonegalitarian Political Organization in Prehistoric Central California." In *Social Archeology*, C. Redman, Editor, Academic press, New York 1978.
- "The Evolution of Complex Political Organization on San Francisco Bay". In *'Antap: California Indian Political and Economic Organization*. L.J. Bean and T.F. King, eds., Ballena Press, Ramona, CA 1974.

Government Guidelines and Regulations

- Draft revised cultural resource management directive and handbook for Department of Veterans Affairs, 2010.
- Regulations, guidelines, and brochures on environmental and cultural resource management, for Department of Agriculture Farm Service Agency (FSA) (unattributed, with FSA NEPA and Cultural Resource staff). FSA, 2004.

Government guidelines and regulations (continued)

- Orders, Guidelines, and Fact Sheets: Cultural Resource Management, Floodplain Impact Management, Wetlands Impact Management, Federal Real Property Disposal, Archeological Collections Management, Indian Sacred Sites Management, Historic Document and Artifact Management, Environmental Justice, and Social Impact Assessment (unattributed, with GSA NEPA Call-In Staff). General Services Administration, Washington DC, 1998.
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- *Guidelines for Evaluating and Documenting Traditional Cultural Properties.* With P.L. Parker. National Register Bulletin 38, National Register of Historic Places; National Park Service, Washington DC, 1990
- *Preparing Agreement Documents.* Advisory Council on Historic Preservation, Washington DC, 1989.
- *Public Participation in Section 106 Review: a Guide for Agency Officials.* Advisory Council on Historic Preservation, Washington DC 1989.
- *Identification of Historic Properties: a Decisionmaking Guide for Managers.* Advisory Council on Historic Preservation and National Park Service, Washington DC 1988.
- *The Section 110 Guidelines: Guidelines for Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act.* With S.M. Sheffield. 53 FR 4727-46, National Park Service, Washington DC 1988
- *Regulations for the Consideration and Use of Historic and Cultural Properties* (Unattributed). Commonwealth of the Northern Mariana Islands Historic Preservation Office, 1983
- *Treatment of Archeological Properties: a Handbook.* Advisory Council on Historic Preservation, 1980.

Popular

- "Recent Cosmic Impacts on Earth: Do Global Myths Reflect an Ancient Disaster?" *About.com,* December 2007, http://archaeology.about.com/od/climatechange/a/masse_king.htm
- "Archaeology and the Fate of Amelia Earhart." *About.com,* June 2005. http://archaeology.about.com/od/pacificislands/a/king_ae.htm
- "Amelia Earhart: Archaeology Joins the Search." *Discovering Archaeology* 1:1:40-47, El Paso; January-February 1999
- "Sea Changes: 14th Century Micronesia." *Glimpses of Micronesia and the Western Pacific* 25:1, Honolulu 1985.
- "Tonaachaw: a Truk Village Rediscovers its Past." With P. Parker. *Glimpses of Micronesia and the Western Pacific* 21:4, Honolulu 1982.
- "How You Can Help the Archeologists." *Boys Life,* Boy Scouts of America, 1971.

Other

- Videotapes on "historic contexts" and "traditional cultural properties," for National Park Service
- "E-Book" environmental review software, for General Services Administration

Other – continued

- "NEPA for Historic Preservationists and Cultural Resource Managers," worldwide web pages for National Preservation Institute.
- "Cultural Resource Management Checklist," interactive worldwide web pages for the Department of Veterans Affairs

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Training, writing, consultation, dispute resolution in cultural resource & heritage management, environmental impact assessment

November 15, 2011

Mr. James Kenna, State Director
Bureau of Land Management
2800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Subject: Comments on the Draft Environmental Impact Statement/Report for the Ocotillo Wind Energy Facility (OWEF)

Dear Mr. Kenna:

At the request of the Viejas Band of Kumeyaay Indians (Viejas), and as part of Viejas' comments to you on the subject, I am writing to comment on the draft Environmental Impact Statement/Report (DEIS/R) for the Ocotillo Wind Energy Facility (OWEF). The DEIS/R has been issued in ostensible compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

My comments, below, are based on some 45 years experience with the above-referenced laws and the National Historic Preservation Act (NHPA) as they relate to historic places, tribal spiritual places, archaeological sites and other "cultural resources," in the California Desert and elsewhere. My qualifications are summarized in the attached resumé, and include:

- Holding a PhD in anthropology, emphasis archaeology, from the University of California, Riverside;
- Forty-five (45) years experience in the practice of cultural resource management, historic preservation, and environmental impact assessment, including ten years overseeing federal agency compliance with Section 106 of the National Historic Preservation Act (NHPA) for the Advisory Council on Historic Preservation (ACHP);
- Coordinating development and authorship of the NEPA procedures of the U.S. General Services Administration;
- Authorship of eight books and numerous journal articles on cultural resource management, historic preservation, archaeology, and environmental impact assessment; and

- Authorship of the federal government's guidelines for the evaluation and documentation of traditional cultural properties (National Register Bulletin 38; see http://www.nps.gov/nr/publications/bulletins/nrb38/).

In my comments, below, I first offer some summary conclusions, based upon the detailed comments that then follow. The detailed comments are organized with reference to those sections of the DEIS/R that (a) lie within my scope of experience and knowledge, that (b) I believe to be deficient or misleading, and that (c) raise questions that I believe need to be answered if there is to be any hope for understanding the OWEF's impacts on the cultural aspects of the environment, including but not limited to historic properties of significance to the Viejas Band. I request that each question be explicitly and honestly answered.

Summary Comments

This DEIS/R is deficient in at least the following ways:

1. The purpose of and need for the project are framed in a virtually incomprehensible manner, but amount to the statement that the project's purpose is to construct the project, and that the federal agencies' need is to approve it expeditiously. This is not the way purpose and need are properly construed under NEPA or CEQA. **EC6d-01**

2. Largely because of this crabbed conception of purpose and need, the DEIS/R fails to address a reasonable range of alternatives that should be considered before a large piece of culturally sensitive public land is committed to a destructive use. **EC6d-02**

3. The DEIS/R effectively ignores the cultural significance of the landscape within which the proposed project would be built, despite repeated efforts by Indian tribes to make the agencies (notably the lead federal agency - the Bureau of Land Management (BLM)) aware of this significance, and despite the fact that part of the landscape is already included in the National Register of Historic Places (NRHP) precisely because of this significance. **EC6d-03**

4. The DEIS/R proposes that effects on "cultural resources" will be avoided by avoiding the physical destruction of specific archaeological sites and features as defined by archaeologists. This ignores the significance of such sites and features, and the landscapes within which they lie, to Indian tribes and others. It also ignores a variety of ambiguities inherent in the very notion of "avoidance" as impact mitigation. **EC6d-04**

5. The DEIS/R does not reflect even the beginnings of compliance with Section 106 of NHPA, which must be complied with before the federal agencies make their project decisions. **EC6d-05**

6. The DEIS/R does not reflect consultation with Indian tribes either in general based on the government's trust responsibilities toward such tribes, or under

NHPA and other specific laws, regulations and executive orders, many of which are not even alluded to in the DEIS/R.

EC6d-05, cont.

7. All this and more leads me to conclude that BLM and the other federal agencies have made their decision to approve the project, and have issued this DEIS/R in a feeble effort to create the appearance of compliance with their legal responsibilities.

EC6d-06

Following are comments on specific parts of the DEIS/R, many of which raise questions in an effort to ascertain what the agencies really intend. Again, I request that each of these questions be responded to in writing, in a clear and straightforward manner[1].

Comments on Section 1.1: "Purpose and Need."

It is a core precept of professional practice under NEPA and CEQA that the purpose of and need for a proposed project must be clearly articulated, so that alternative means of achieving the purpose and addressing the need that pose fewer adverse effects and significant impacts on the environment can be fairly evaluated. If the purpose and need are not clear, there is no rational basis for making such an evaluation.

This section presents the project's purpose and need in such a confusing, wordy, and unclear manner that it becomes very difficult to ferret out what they really are. The actual purpose of and need for the proposed project are buried in a thicket of verbiage about the purposes of and need for the various agency programs under which the project proposal is being advanced.

EC6d-07

Section 1.1.1, entitled "BLM Purpose and Need," employs a great many words to say very little; the only purpose and need they articulate are "to respond to a FLPMA ROW application submitted by the Applicant." This may be BLM's purpose, and what BLM needs to do, but it tells us nothing about the purpose of or need for the project itself.

Section 1.1.2, "Department of Energy Purpose and Need," is even more obfuscatory, never actually saying what DOE perceives the purpose of or need for anything to be. To the extent that anything understandable can be deduced from this section, it appears that DOE's purpose and need are to provide financial assistance to the applicant as quickly as possible.

EC6d-08

Section 1.1.3, ostensibly outlining the "basic and overall project purpose and need" as understood by the Corps of Engineers, throws 316 largely irrelevant words into the discussion before finally revealing that "(t)he overall project purpose is 'To provide a wind energy facility ranging in size from approximately 315 MW to 465

[1] Let me recommend the BLM publication at http://books.google.com/books/about/Gobbledygook_has_gotta_go.html?id=Be1MPAAACAAJ for guidance in preparing such responses.

MW in Imperial County, California.'" In other words, the purpose of the project is to build the project. The Corps does not address why the project is needed.

EC6d-08, cont.

Section 1.1.4, on the applicant's objectives, is somewhat clearer. Here we finally learn (though we are never explicitly told) that the purposes of the project are to:

- "help meet federal and state renewable energy supply and greenhouse gas (GHG) emissions reduction requirements;"
- "develop a source of renewable electric power that can be placed into service in an expeditious manner;" and
- "assist California and its IOUs (investor owned utilities) in meeting the State's Renewables Portfolio Standard (RPS) and GHG emissions reduction requirements."

EC6d-09

Section 1.1.5, "CEQA Objectives," further clarifies the purpose of (though only implicitly the need for) the project by saying it is intended to "help meet California's Renewable Portfolio Standard (RPS) requirement for renewable energy." It is to do this by: "(d)evelop(ing) a wind energy project on the windiest sites available to maximize energy production and provide the lowest-cost renewable, non-polluting electricity."

From all this (amid much more) verbiage, we may deduce that the purpose of the project is to develop a source of clean, renewable electric power in an expeditious manner, via development at "the windiest sites available." We may presume, though the DEIS/R never tells us, that the need for the project is to reduce dependence on fossil fuels, especially those derived from outside the United States, and to improve air quality. If this is an accurate statement of the project's purpose and need, then it is at least theoretically feasible for the federal agencies to consider a respectable range of other alternatives, but if the project's purpose and need is simply to build the project, or fulfill the agencies' responsibilities to the project applicant, then (as discussed below), the alternatives analysis becomes a joke. This analysis ought not be a joke, as discussed below.

EC6d-10

Please clarify which interpretation of the project's purpose and need is accurate.

Comments on Section 1.5.1, "Relationship to Federal Plans, Policies, Programs, and Laws."

This section's treatment of the *National Environmental Policy Act* (NEPA) ignores the law's core requirement, set forth at Section 101(b). Here Congress articulated the actual policy alluded to in the act's title, directing that "it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may --

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

3. attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

4. preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

5. achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The DEIS/R should be revised to document clearly how the responsible federal agencies will ensure that these congressional mandates are met, with specific reference to items 1, 2, 3, and 4. **EC6d-11**

Similarly, your treatment of the *National Historic Preservation Act* (NHPA) is incomplete, inadequate, and flatly misleading. First, without saying so, it addresses only the requirements of NHPA Section 106, ignoring the requirements of other sections. Notable among the sections you ignore is Section 110, which requires that federal agencies, among other duties:

1. Exercise stewardship over historic properties under their jurisdiction or control;

2. Accept responsibility for the effects of their actions on historic properties not under their jurisdiction or control; **EC6d-12**

3. Conduct their activities in accordance with the broad purposes of NHPA, and consider ways to advance these purposes; and

4. Conduct their activities in consultation with a broad range of interested parties, notably including Indian tribes.

You may not wish to attend to these responsibilities, but without Congressional authorization to waive them, you are not permitted simply to pretend that they do not exist.

Second, the DEIS/R misrepresents the requirements even of NHPA Section 106 and fails to recognize the applicability of the regulations implementing this section. This misrepresentation is especially egregious in suggesting that Section 106 requires only that the State Historic Preservation Officer (SHPO), any "potentially affected" Indian tribe, and the Advisory Council on Historic Preservation (ACHP) be given "an opportunity to comment on the undertaking." In fact, these and other parties are to be consulted about effects on historic properties, following specific procedures set forth in the regulations, in a manner designed to reach binding agreements about how adverse effects will be resolved. **EC6d-13**

Consultation, as defined in the Section 106 regulations, clearly means good-faith negotiation in search of agreement – not merely sending out letters or other documents for review and ostensibly considering comments. Such consultation is very different from the mere solicitation of comments on your documents, which seems to be the most you have done thus far. Although agreement may not always be reached, consultation requires an effort to reach agreement, through shared weighing and balancing of alternatives.

EC6d-13, cont.

Third, Federally-recognized tribes have special rights to be consulted under the statute - notably Section 101(d)(6)(B) whenever historic places of cultural or religious significance to them are involved, and Section 110 in agency decision making about the identification and management of historic properties.

Please correct the DEIS/R not only to properly represent what NHPA actually requires, but to document how the federal agencies involved in this project have complied with its requirements. Mere assurances that these authorities will somehow be complied with are insufficient, particularly because compliance with NHPA requirements is necessary to inform compliance with NEPA and CEQA. Historic properties as defined under NHPA are important aspects of the human environment. It is unreasonable to assert that you have considered the project's impacts on that environment when you have failed to complete the studies and consultations necessary to characterize and address impacts on historic properties.

EC6d-14

Other relevant federal laws and executive orders are not even noted in this section. Notable by their absence are the *American Indian Religious Freedom Act* (AIRFA), the *Religious Freedom Restoration Act* (RFRA), the *Native American Graves Protection and Repatriation Act* (NAGPRA), and *Executive Order 13007*. These authorities directly or indirectly (as through the NAGPRA regulations at 43 CFR 10) require consultation with tribes whose religious practices, spiritual places, and/or ancestral graves and cultural items may be affected by a project; the DEIS/R alludes vaguely at various points to BLM's alleged consultation with tribes, but provides no notion of how this consultation is addressing the relevant legal authorities. Please revise the DEIS/R to ensure that these authorities are addressed and applied to the proposed project.

EC6d-15

This section also gives short shrift to the BLM's land use classifications under the *California Desert Conservation Area Plan* (CDCAP). This classificatory scheme was presumably established for a purpose, and under it the area of the proposed project is classified as "L" for limited use. This classification is easily understandable, particularly given the site's adjacency to Anza-Borrego Desert State Park and a number of areas of critical environmental concern (ACECs). The DEIS/R treats the proposal to amend the CDCAP to allow the project as a sort of ho-hum routine matter. If BLM's prior extensive land use planning effort under the Federal Land Policy and Management Act (FLPMA) is to have any meaning at all, surely such an amendment should be given more serious and critical consideration.

EC6d-16

Comments on Section 1.5.2: "Relationship to State and Local Laws, Plans, Policies, and Programs"

Your representation here of the State Historic Preservation Officer (SHPO) entirely ignores the SHPO's role in the review of federal agency projects like this one under the regulations implementing Section 106 of the National Historic Preservation Act. Was this misrepresentation intentional?

The DEIS/R is also deficient in failing to acknowledge the project's relationship to the adjacent Anza-Borrego Desert State Park. Surely permitting a large-scale industrial facility next door to a state park requires some sort of coordination with the State. EC6d-17

In Table 1-1, it is not accurate to represent "NHPA Section 106 Consultation" as an "entitlement" awarded by the SHPO. NHPA Section 106 consultation is the responsibility of federal agencies, in this case BLM, DOE and the Corps of Engineers, and is overseen by the ACHP. It is not an "entitlement" by any definition.

Comments on Section 1.7: "Interagency Coordination"

This section states that "BLM has notified affected Indian Tribes regarding the proposed OWEF, is seeking their comments, and has invited them to consult on the project on a government-to-government basis." This is all very well, but the *results* of tribal consultation need to be reflected in the EIS/R. How do you propose to do this, particularly if you are going to finalize the EIS/R before completing (or even truly starting) tribal consultation? As noted above, the DEIS/R also needs to address explicitly the consultative and other requirements of NHPA, NAGPRA, RFRA, AIRFA, Executive Order 13007, and their applicable regulations. EC6d-18

This section fails to mention consultation with tribes, the SHPO, the ACHP, and other interested parties under Section 106 of NHPA. How is this consultation and its results to be reflected in agency planning and decision making, and in the EIS/R? Do you propose to finalize the EIS/R without completing Section 106 review? If so, why, and how do you justify this?

Comments on Section 2.1: "Introduction" (to Chapter 2 on the Action and Alternatives)

Considering how obtusely the purpose and need for the project have been defined (see above), how is it possible for you to know which alternatives "respond to the purpose of and need for the project?"

Given that the purpose of the project, as defined at Section 1.1.3, is to build the project, does not Section 2.1.1 create a Catch-22 when it requires that alternatives "fulfill all or most of the purpose, need, and objectives identified in Chapter 1?" If an alternative to building the project must fulfill the purpose of building the project, how is it an alternative? EC6d-19

Comments on Section 2.4.1, Discussion of Alternatives.

Here you finally define the project's purpose (if not the need for it), saying that "the overall project purpose is 'to provide a wind energy facility ranging in size from approximately 315 MW to 465 MW in Imperial County, California.'" As noted above, this effectively means that the purpose of the project is to build the project. Such a circular definition of purpose automatically renders all alternatives null and void. The only conceivable alternatives that the agencies can consider are those that allow building the project in one form or another. This point is confirmed in Section 2.8.6, where the alternative of rooftop solar power generation is briefly discussed and rejected "because (it does) not respond to the Agency's purpose and need for the Proposed Action to respond to a ROW application for a wind energy generation facility on public lands." Although here the purpose and need has been reformulated from "build the project" to "respond to the ROW application," the effect is the same. The project as proposed is the only alternative that can meet the purpose and need as formulated. You have simply declined to consider a range of other alternatives that might produce the same amount of energy as the OWEP, or more, at lower cost, without requiring the sacrifice of publicly controlled land of cultural significance to Viejas – rooftop solar being only one such alternative. EC6d-20

This sort of manipulation of purpose and need to eliminate consideration of alternatives is contrary to the intent of NEPA and CEQA. The NEPA regulations, for example, at 40 CFR 1502.14, note that the discussion of alternatives is "the heart of the environmental impact statement," and guidance provided by the State Resources Agency for compliance with CEQA also stresses the need to address alternatives (14 CCR 15126.6). Creating a situation in which no alternatives can be considered other than minor variants on the action as proposed effectively cuts the heart out of the DEIS/R, rendering it meaningless. It is apparent that the decision to approve the project has been made; the only residual questions are what measures might be adopted in an effort to mitigate its impacts.

Do you perceive some bar, perhaps grounded in government policy or in case law, to actually considering meaningful alternatives to the project, including off site alternatives? If so, please explain what it is. Please do not suggest that you cannot consider alternatives that are outside the applicant's abilities or BLM's scope of authority; note that the answer to question 2(a) in the Council on Environmental Quality's well-known "Forty Most Asked Questions Concerning CEQ's NEPA Regulations" (1981) noted that "(r)easonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant;" while the answer to question 2(b) noted that "(a)n alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable," going on to say that "(a)lternatives that are outside the scope of what Congress has approved or funded must still be evaluated in the EIS if they are reasonable, because the EIS may serve as the basis for modifying the Congressional approval or funding in light of NEPA's goals and policies." EC6d-21

Comments on Section 3.4: "Cultural Resources."

You define "cultural resources" as "locations of human activity, occupation, or use." This is a much narrower and more exclusive definition than those found in much of the pertinent professional literature (wherein traditional beliefs and practices, ways of life, subsistence practices, culturally important animals and plants, and other culturally valued phenomena are included). Have you a statutory, regulatory, policy, or other basis for defining the term so narrowly? If so, please specify what it is. **EC6d-22**

You also say that "cultural resources" can be "places that are considered to be of traditional cultural or religious importance to social or cultural groups." By whom do you think such a place must be so "considered" in order to be called "cultural resources" and included in your analysis? Is it sufficient in your eyes for a tribe or other group to "consider" a place to have cultural or religious importance, or do you think it is necessary for some state or federal governmental authority to thus "consider" it? **EC6d-23**

You acknowledge that traditional cultural properties (TCPs) may "include natural landscape features," but you do not mention landscapes per se. Do you or do you not agree that a landscape as a whole can be a TCP? **EC6d-24**

You report that several "cultural resource" studies have been undertaken in connection with this EIS. With respect to Indian tribal TCPs, however, such studies have apparently <u>not</u> been undertaken. What is the rationale for this, and how do you propose to correct this deficiency? Do you believe that you can arrive at reliable conclusions about whether and how the project will affect such properties without conducting and completing such studies prior to considering the project's effects? If so, how? **EC6d-25**

In responding to these questions, please do not insult the readers' intelligence by assuring us that such studies will be undertaken as "mitigation" for project effects. While mitigative studies might be agreed to by consulting parties under Section 106 of NHPA, there is no evidence that you have even <u>initiated</u> Section 106 review, let alone reached agreement about mitigation measures. In any event, post-decision studies cannot possibly inform pre-decision impact evaluation, which is after all the ostensible purpose of the DEIS/R. **EC6d-26**

Your definition of a "Region of Influence" (ROI) is far more complicated than the standard definition of "area of potential effects" (APE) found in the regulations implementing Section 106 of the National Historic Preservation Act. Please explain your rationale for inventing this new term and establishing a project-specific system for applying it, rather than following the requirements of the relevant regulations. **EC6d-27**

You include among the categories of land areas that fall within the "ROI":

"Any cultural resource or location that may be identified by a consulting party, organization, governmental entity, or individual through consultation or the public commenting processes as having significance or being a resource of concern," and

"Historic Districts and Landscapes that include all or portions of any of the project components listed under Category 1" (that is, areas where ground will be disturbed).

Please help the reader understand these categories and how you apply them. Hypothetically, should the Viejas Band identify the entire landscape within which the project is proposed, extending out from the project site for, say, five miles in every direction, as a "resource of concern" by virtue of its being an historic landscape of traditional cultural significance to the Tribe, may we conclude that you would accept this as including the entire landscape within the ROI? EC6d-28

Comments on Section 3.4.1.1, "Cultural Setting"

This section is entirely cast in the past tense, and is overwhelmingly archaeological in orientation. The uninformed reader could easily gain the impression that there are no living cultural groups associated with the area. There is a vague reference to relationships between the Kamia and the Kumeyaay (with whom the Kamia are acknowledged to have "shared clans or lineages"), but no indication that anyone has thought about the relationships of living Kumeyaay groups to the area, or discussed its resources with any living community. EC6d-29

There are in fact twelve living Kumeyaay Bands, many of them closely related to the Kamia. Their cultural values and relationships to the ROI's resources, notably including those of the federally-recognized Viejas Band, constitute a significant aspect of the "cultural setting" that is entirely ignored in the DEIS/R. By thus ignoring the living tribal communities associated with the area, the DEIS/R effectively ignores a major aspect of the project's "cultural setting." How do you propose to correct this flaw and actually consider the cultural setting of the project in planning and decision making?

Comments on Section 3.4.1.2, "Identified Cultural Resources."

Despite its title, this section does not address "cultural resources." It addresses specific archaeological sites as defined by archaeologists, and aspects of the "built environment" as understood by the same parties or perhaps by architectural historians and historians. Notably absent is any consideration of cultural resources as defined and understood by Indian tribes associated with the area, including but not limited to the Viejas Band. The archaeological bias of this section is clear from its very beginning, where it is acknowledged that the method employed for identifying EC6d-30

"cultural resources" was an "archaeological survey." Please review and revise your terminology to avoid misleading the reader.

This section is replete with terms of art that are doubtless understandable to archaeologists specializing in the area, but are not informative to the non-specialist reader. Please explain what constitutes a "site," and an "isolate." Please define the terms of art employed in the various tables, for example "lithic scatter," "ceramic scatter," "temporary campsite," "knapping station," and "bedrock milling." The discussions provided later in the text are useful, but to make the early portions of this section understandable, definitions are needed at the outset. How were these characterizations and this nomenclature decided upon, and by whom? How and by whom was it decided how to assign observed phenomena to classes?

EC6d-31

Why is it the case that locations "previously recorded on the basis of General Land Office (GLO) notes rather than (based upon?) archaeological evidence" are known to be "not archaeological sites" and hence are ignored? Do you actually know what evidence the GLO used? Do you assume the GLO mappers just made things up? Have you visited the sites to see what is there? And if this is a report on "cultural resources," why does it matter whether the GLO sites are "archaeological sites" or not? For that matter, what is an "archaeological site" as this term is used in the DEIS/R?

EC6d-32

Please explain how the project has been redesigned to avoid both the Spoke Wheel Geoglyph CA-IMP-6988 and its "important viewshed to the east toward Coyote Mountain." Please clarify:

- What does "avoid" mean in this context?
- Was the redesign accomplished in consultation with those who value the site and the view from it?
- What are the opinions of such parties about the redesign, and the effectiveness of its "avoidance?"
- How do you know that the "important viewshed" is to the east toward Coyote Mountain?
- If this is an important viewshed, are the viewsheds toward Coyote Mountain from other locations also likely to be important?
- Is the viewshed from Coyote Mountain itself or from other locations likely to be valued?
- From my examination of the archaeological survey report that informed preparation of the DEIS/R, it appears that in fact a line of wind turbines is proposed only half a mile east of the Spoke Wheel Geoglyph, and that half a dozen or so additional turbine rows will be arrayed farther to the east. If this

EC6d-33

is the case, how can you say that the Geoglyph's viewshed has been "avoided?" **EC6d-33, cont.**

How has the segment of Old Highway 80 been "avoided," if it "passes through the project area?" Is this not an oxymoron? **EC6d-34**

How were the archaeological "site types" defined, by whom, and on what basis? Were any traditional cultural authorities, or other authorities, consulted in developing such definitions? What is the basis for assigning places and things to types? **EC6d-35**

What do you mean by "Based on the results of the records search, a similar pattern of prehistoric lithic procurement in the project area could be found?" Similar to what? Found where? **EC6d-36**

If "geoglyphs exist in the project area," how is it that "no sites ... have been characterized as Geogylph sites?" Is this simply an accident of the fact that "(t)hey all occur in combination with other site types?" How many geoglyphs actually are recorded in the area?" **EC6d-37**

What do you mean by "ethnographic research issues?" Are these topics that BLM (or someone) expects to investigate through ethnographic research? If so, when, and how? Who is going to do it, and how will the tribes whose members will presumably be its subjects be involved? How will its results inform the Final EIS/R (FEIS/R) and decision making about the project? Why are these research issues outlined and not others? **EC6d-38**

What is a "BLM Class III intensive survey?" **EC6d-39**

Was this survey conducted by contractors for the project proponent? If so, why should the reader trust their observations and reportage to be unbiased? **EC6d-40**

How does the "direct impact APE" relate to the ROI, and vice-versa? **EC6d-41**

What do you understand to constitute a "direct impact?" Please refer to the definition of this term at 40 CFR 1508.8(a). **EC6d-42**

If "(t)he direct impact APE consists primarily of corridors in which lines of wind turbine towers would be placed," does this mean that your survey addressed only corridors separated from one another by unsurveyed corridors? If this is the case, and the surveyed corridors were 1,000 feet wide as reported, how wide were the intervening unsurveyed corridors? **EC6d-43**

What is a "BLM Class II sample survey?" **EC6d-44**

What do you mean by "the ROW boundary?" **EC6d-45**

Upon what bases were "potential significance" and "integrity" judged, and by whom? **EC6d-46**

How were the tribal participants selected, according to what criteria, and by whom? Did tribal governments participate in the selection process? To whom did these participants report, and how were their observations reflected in the survey documentation? What were they instructed to observe, and to whom did they report their observations?

EC6d-47

The brief discussion of "indirect impacts outside the project area" is confusing. Earlier you said that you had established a "region of influence" (ROI) which more or less approximated the "area of potential effect" (APE) within which effects on historic properties are identified under the regulations implementing Section 106 of the NHPA (36 CFR 800). The APE, according to its definition at 36 CFR 800.16(d), is "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." The APE for this project, and hence the ROI, thus must extend well beyond the boundaries of the "project area," and embrace all areas where direct or indirect effects are possible. Have your surveys in fact addressed the entire ROI, or only the project area? Please clarify what you have done to identify historic properties within the ROI outside the project area.

EC6d-48

The same discussion implies that you regard visual impacts as "indirect." Is this the case? If so, what is the basis for this equation, considering that visual impacts, just as much as physical, auditory, olfactory, and other effects, may be "caused by the action and occur at the same time and place" (40 CFR 1508.8(a)).

EC6d-49

When you say that "(a) total of 200 of these (archaeological sites) or 66 percent are strictly lithic scatters," whose perceptions are you reflecting? If the statement reflects the judgment of the archaeologists who recorded the "scatters," is there any particular reason to accept this judgment as authoritative? What did your tribal participants have to say about "scatters?"

EC6d-50

Table 3.4.3 summarizes data on several hundred archaeological sites identified by the survey, which apparently covered only selected corridors within the project construction area, plus some sample tracts. It is not entirely clear how these data (often represented in the table as incomplete) were aggregated to arrive at the summary numbers in Table 3.4.4, but it is clear from both tables that "sites" as you define them are quite thick on the ground in the project area. Given that the survey addressed only selected corridors and sample tracts, can you project a likely total number of each site type within the project area? Within the ROI?

EC6d-51

The viewpoint that characterizes this section of the DEIS/R is an atomizing one: you break up the world of observations into a great many individual "sites," "features," and "isolates." Another way to look at the data is holistically, viewing all these phenomena as elements of an overall cultural landscape or landscapes. To some extent you undertake this kind of characterization when you group features and artifacts into "sites," and note the concentration of agave-roasting sites and features in the northwestern portion of the project area, but on the whole the phenomena

EC6d-52

recorded are viewed in isolation from one another. Why have you taken this approach, when even in archaeological practice the importance of understanding landscapes and sites within environments has long been understood? **EC6d-52, cont.**

Can you offer any generalizations on the project area or ROI as a whole, as a cultural landscape characterized by many individual activity areas? Can you generalize about how the area appears to have been used, by how many people, and for how long? Can you compare this area with other parts of the California Desert or other regions that have been subjected to comparable levels and kinds of investigation? **EC6d-53**

In Section 3.4.1.3, "Built Environment," the "project area" is defined to include "a one-mile buffer around the public lands." Is this how "project area" was defined for purposes of the archaeological survey as well? How does this area relate to the ROI? **EC6d-54**

Is there a reason that the list of "applicable regulations, standards, and plans" given at Section 3.4.2 is more complete (in some respects) than the list given in Section 1.5.1? **EC6d-55**

Section 3.4.2 suggests that the regulations at 36 CFR 800 are for implementing the NHPA as a whole. This is misleading; the regulations guide only implementation of NHPA Section 106, while other regulations (e.g. 36 CFR 60) relate to other sections of the statute. **EC6d-56**

Contrary to Section 3.4.2, Section 106 of the NHPA does not "set forth the procedures for identifying and evaluating eligible properties and assessing the effects of federal undertaking on those historic properties." These procedures (among others) are outlined in the regulations implementing Section 106 (36 CFR 800), and they are only some of the procedures there outlined – many of which you appear to have ignored.

Similarly, "(t)he goal of the Section 106 process" is not "consultation with interested parties." Consultation is a vital tool used by the process to achieve its actual purpose, summarized at 36 CFR 800.1(a) as being "to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning." This is an important distinction. Consultation is not to be undertaken simply for the sake of consulting, but to achieve the purpose of accommodating historic preservation concerns with other public interests – in this case, the interests of renewable energy development. Nor is consultation all that is involved in Section 106 review; importantly, the regulations require that alternatives to avoid, minimize, or otherwise mitigate project effects be explored. **EC6d-57**

While it is true that "(a)s part of the Section 106 process, agencies are required to consult with the SHPO," the SHPO is by no means the only party with which

agencies are required to consult. Indian tribes, local governments, and other interested parties are also to be consulted.

Section 106 review does not "ensure that the decisions of federal agencies concerning the treatment of (historic) places result from meaningful considerations of cultural and historic values and of the options available to protect the properties." It is designed to ensure that decisions result (in part) from such considerations, but it is not automatically successful, so it in fact "ensures" nothing. The success of Section 106 review depends on the honesty and good will of those involved, notably including federal agency officials. To portray Section 106 review as some kind of insurance policy is deeply misleading. Please correct this statement.

EC6d-57, cont.

The statement that "when undertakings are found to affect historic properties under Section 106 of the NHPA, consultation with SHPO under 36 CFR 800, and the BLM Manual 8100 series is required" is not accurate. When such effects are found to be likely, consultation is required not just with the SHPO but with all the parties outlined in 36 CFR 800, in accordance with those regulations. It should be noted that the OWEF will have such effects and thus must be subjected to consultation.

Please correct this section to reflect the statutory and regulatory requirements accurately.

Your discussion of the American Indian Religious Freedom Act (AIRFA) in this section is rather narrow, and fails to explore the important linkages between AIRFA and the Religious Freedom Restoration Act (RFRA). Please reconsider and amend this discussion.

EC6d-58

Since the "NEPA compliance process" does not explicitly require consultation with Indian tribes except where projects will be carried out on reservation land (See 40 CFR 1503.1(a)(2)(ii)), how exactly does BLM comply with AIRFA and Executive Order 13007 "as part of the NEPA compliance process?" And why does it not comply with these authorities as part of review under NHPA Section 106, which itself requires consultation with tribes?

EC6d-59

The Native American Graves Protection and Repatriation Act (NAGPRA), and its implementing regulations (43 CFR 10) require much more than merely "responding to discoveries of Native American human remains and associated funerary objects on federal land." Notably, federal agencies are required to develop plans of action (POA) in consultation with tribes when considering undertakings that may disturb such remains and objects, as well as sacred objects and objects of cultural patrimony, and then carry out the terms of such POA if and when they proceed with such undertakings. Please correct the text of this section to reflect the actual requirements of the law and regulations.

EC6d-60

While Indian trust assets, narrowly construed, may not be involved in this project, it is inaccurate to imply that this excuses the federal agencies involved from the

EC6d-61

exercise of their trust responsibility to tribes. Besides the management of narrowly defined trust assets per se, the federal government has a broad trust responsibility to respect and protect tribal interests, notably including interests in the public lands and their resources. As discussed below, the government also has environmental justice-based responsibilities toward tribes based on their status as low-income and minority populations. How have these issues been addressed in the environmental review process? Please reconsider the crabbed interpretation of your trust responsibilities reflected in this section.

EC6d-61, cont.

Comments on Section 3.5: "Environmental Justice"

This section provides an object lesson in how to avoid attending to environmental justice (EJ) issues by adhering narrow-mindedly to government guidelines. The fundamental purpose of Executive Order 12898 is to ensure that federal agencies seek to avoid disproportionate adverse environmental impacts on low-income and minority communities. Among the tools that have been provided by the Environmental Protection Agency (EPA) and others for achieving this purpose is the guidance referred to in Section 3.5.1. You have cleverly used this guidance to create the impression that the federal agencies responsible for this project have no EJ responsibilities, notably with respect to Indian tribes.

EC6d-62

In point of fact, this project will have obvious disproportionate adverse environmental impacts on the Viejas Band and other tribes that have cultural associations with the lands to be affected. The tribes are minority and in general low-income communities, and it is their cultural resources, not those of the general population, that will be most drastically impacted by implementation of this project. The fact that the tribes do not happen to reside within one-half mile of the proposed OWEF site is irrelevant – particularly given that where the tribes do reside is largely a function of where they have been forced to locate themselves through alienation of their ancestral lands.

Comments on Sections 3.10 and 4.9: "Noise"

The discussion in Section 3.10 of studies in Scandinavia suggest that noise in rural areas is likely to constitute a significant impact than comparable noise levels in an urban area. The area surrounding the OWEF is obviously a rural area. Although the DEIS/R shows no appreciation for this fact, it seems likely that people (notably but not exclusively tribal people) engaged in quiet cultural/spiritual/contemplative activities in the landscape in and around the OWEF site, including the vicinity of the National Register of Historic Places (NRHP)-listed Spoke Wheel Geoglyph, are likely to be "sensitive receptors" of such noise. Please explain why this issue is not considered in the DEIS/R, in both Section 4.9 on noise impacts and in Section 4.4 on "cultural resource" impacts.

EC6d-63

Comments on Sections 3.18 and 4.17: "Vegetation Resources"

The DEIS/R appears to present no data on whether and how tribes (or other groups) in the area use and/or ascribe cultural value to vegetation resources such as agave and mesquite, or on the project's potential impacts on such uses and ascriptions. What is the reason for this omission?

EC6d-64

Comments on Section 3.19 and 4.18: "Visual Resources"

The DEIS/R appears to provide no analysis of visual impacts on historic properties or "cultural resources" however defined, or on human use of culturally significant places. Even the NRHP-listed Spoke Wheel Geoglyph, whose viewshed is explicitly discussed in its nomination documentation and in the "Cultural Resources" section of the DEIS/R, is ignored. What is the reason for this omission?

EC6d-65

Comments on Section 3.21: "Wild Horses and Burros"

This section reports only that there are no established BLM Herd Management Areas (HMAs) in the vicinity. This tells us nothing about whether there are wild horses and burros in the area, or about what the project's effects may be on these iconic animals. Is it your assumption that wild horses and burros are careful to remain in HMAs, or that any who stray outside an HMA need not be considered in an environmental analysis? If not, what is the reason for failing to discuss impacts on wild horses and burros?

EC6d-66

Comments on Sections 3.23 and 4.21: "Wildlife Resources"

The DEIS/R appears to say nothing about how tribes may use or value wildlife resources, or what the impacts of the project may be on such uses and values. What is the reason for this omission?

EC6d-67

Comments on Section 4.4: "Cultural Resources" (effects on)

This section begins with the statement that: "The purpose of the present cultural resources analysis is to provide evidence of the ongoing public process by which the BLM and Imperial County are jointly complying with Federal, State, and local regulations to which each agency is variously subject. Imperial County is the lead agency for the purpose of complying with CEQA." Please reconsider this statement, which is almost as silly as your construction of the project's purpose and need. To say that the purpose of the analysis (a process) is to provide evidence of the process is circular and meaningless.

EC6d-68

Comments on Section 4.4.2: "Cultural Resources Analysis"

The statement that "Cultural resources that can be avoided by construction may remain unevaluated" creates a hole in your analysis through which many large trucks could be driven.

EC6d-69

- First, what do you mean by "avoided?" That no one will touch them? Go near them?
- How near? Ten meters? One meter? One centimeter?
- And if this is what you mean, do you think this will result in an avoidance of impact?

EC6d-69, cont.

In the (unlikely) event you could really avoid all physical impact to a place, in perpetuity, this might avoid impact on its archaeological values (you wouldn't churn up its soil deposits and artifacts, but alterations of its surroundings could still occur, which might detract from its research, setting and other values), but it would do nothing to avoid visual, auditory, and other effects that are not strictly physical, not strictly on archaeological research values.

The statement also reflects the atomizing approach alluded to above, in which the universe of "cultural resources" in the ROI is broken up into tiny little pieces, ignoring the whole that they comprise. It is rather like saying "we won't hurt you by shooting you, because we intend to avoid hitting any vital organs." The statement appears designed to lull the reader into thinking that the project's effects are much more minor and easily controlled than they are. Please strike this statement, and consider all the resources that are subject to effect, as the laws and regulations require. This need not be (and indeed ought not be) done on an atomistic, place-by-place basis; it can be done collectively, with reference to the overall landscape, but it must be done if you are to inform yourselves, the tribes and the public of the actual impacts of the project on "cultural resources," even as you narrowly have defined them here.

EC6d-70

Your discussion of "evaluation of historical significance under NEPA" confuses NEPA with NHPA. It is not true that "(t)he federal significance of an archaeological site or a built environment resource is defined by the NRHP." The significance of such a site or resource for the purposes of NHPA is defined by the NRHP, but NEPA is a different statute with a different scope.

The NEPA regulations, at 40 CFR 1508.27(b)(3), say that among the factors to be considered in judging the intensity of a project's impact on the quality of the human environment is "proximity to... historic or cultural resources." Neither the term "historic resources" nor "cultural resources" is defined in the regulations, and potential impacts on places included in or eligible for the NRHP are identified separately as an intensity measure at 40 CFR 1508.27(b)(8). By first confusing "historic resources" and "cultural resources" and then equating the former term with places eligible for the NRHP, you seem to be trying to narrowly constrict the scope of NEPA analysis. Please reconsider and revise your treatment of NEPA, so that you address impacts on the quality of the human environment as the statute requires, rather than ignoring those cultural aspects of the environment that you think do not qualify for the NRHP.

EC6d-71

It is not true, as you state in the next paragraph, that "cultural resources are considered during federal undertakings chiefly under Section 106 of the NHPA." As noted above, it is NEPA, not NHPA, that refers to "cultural resources;" the term is never employed in the NHPA. NHPA deals with only a subset of resources that may have cultural value: "historic properties." Please correct your terminology and reconsider and revise your conception of the statutory requirements – and explain how you are dealing with cultural resources, as opposed simply to historic properties, under NEPA.

EC6d-72

Under Section 106 of NHPA, federal agencies are not just required to, as you put it, "assess the effects of an undertaking on cultural resources (sic) to determine if they are adverse, and if so to propose mitigation measures to resolve such impacts." Very importantly, agencies are required to do these things in consultation with a range of interested parties, including Indian tribes, and either reach agreement with these parties (memorialized in a memorandum of agreement (MOA) or programmatic agreement (PA)) or afford the ACHP the opportunity to make final comments to the responsible agency head, who must respond to them and may not delegate this responsibility. Please correct your representation of Section 106's requirements.

EC6d-73

It is very true that "project compliance with NEPA does not mean the project is in compliance with the NHPA," but it is also worth noting that project compliance with Section 106 of NHPA does not necessarily mean the project is in compliance with NEPA, NAGPRA, or any other statutory or regulatory authority. The federal agencies involved in this project must comply with all the pertinent laws and regulations, not just those they select to address, and they cannot substitute compliance with one for compliance with another.

EC6d-74

It is also true that "All three steps (in the Section 106 process) require consultation with interested Native American tribes, local governments, and other interested parties," but they also require consultation with the SHPO, and where adverse effects are involved (as they obviously are here), the ACHP must be invited to consult as well. Please correct your statement about who must be consulted.

EC6d-75

How does the "project area of analysis" discussed in the subsection so titled relate to the ROI outlined in Section 3.4, or to the APE for the built environment outlined in subsection 3.4.1.3?

EC6d-76

What do you mean by "ethnographic resources?" Resources important in ethnographic research?

EC6d-77

What is a "cultural resources inventory" and why is it "a necessary step?" Why have you not instead undertaken the reasonable and good faith efforts to identify historic properties in consultation with interested parties that is required by the Section 106 regulations?

EC6d-78

What is the basis for your statement that "in practice, a 'direct effect' under Section 106 is limited to the direct physical disturbance of a historic property?" This

EC6d-79

limitation is found nowhere in the Section 106 regulations, or in any known guidance provided by the ACHP. Similarly, what is the source for the idea that "(i)mpacts that are immediate but not physical in character … are referred to in the Section 106 process as 'indirect impacts?" Please note that the Section 106 regulations, at 36 CFR 800.5(a)(2)(v) give as an example of adverse effect the "(i)ntroduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features," and in no way suggest that such an effect is "indirect." In practice, visual, auditory, and other effects that do not necessarily involve physical disturbance are regarded as "direct effects" under Section 106, as they are under NEPA, if they are "caused by the action and occur at the same time and place" (40 CFR 1508.8(a)); the "physicality" of the effect is irrelevant. Please reconsider your erroneous and misleading statements.

EC6d-79, cont.

What do you mean by "undifferentiated" with respect to cumulative effects under Section 106? In fact, in Section 106 practice cumulative effects are defined just as they are under NEPA and CEQA, as the effects of the proposed action considered in the context of other past, present, and reasonably foreseeable future actions. They are "undifferentiated" from other impact types in that they are discussed and addressed along with direct and indirect impacts, but the same can be said for their consideration under NEPA and CEQA. They are certainly not to be ignored. Please refer to the ACHP guidance at http://www.achp.gov/106q&a.html#800.5, which says:

> *To the extent that Section 106 and NEPA share common concepts, the terminology, such as "reasonably foreseeable," will have the same meaning, and the established NEPA definition will be followed. Only in rare circumstances, such as where the NHPA gives a term a particular definition or a court has interpreted Section 106 language, may the terminology differ.*

Please clarify what you mean by "undifferentiated" here, and ensure that cumulative impacts are properly addressed under Section 106 as well as NEPA and CEQA.

EC6d-80

You are correct in saying that "(w)hile NEPA must assess effects to National Register-eligible cultural resources (identified through the Section 106 process), it must also consider effects to cultural resources that may not be subject to (NRHP) significance evaluation," but you veer off-track when you go on to say "such as traditional cultural properties." Do you think that traditional cultural properties (TCPs) are somehow not to be evaluated and addressed under Section 106 of NHPA? And why do you think that this type of property, as opposed to others, might "not be subject to significance evaluation?" Have you forgotten that in 1992 Congress amended NHPA to include Section 101(d)(6), specifically reminding agencies that such properties, when significant to Indian tribes, can be eligible for the NRHP and requiring that agencies consult with tribes about them under Section 106?

EC6d-81

TCPs comprise a class of property that like any other class may or may not be eligible for inclusion in the NRHP (See National Register Bulletin 38 at http://www.nps.gov/nr/publications/bulletins/nrb38/ for details; see also National

EC6d-82

Register Bulletin 30 regarding Rural Historic Landscapes at http://www.nps.gov/nr/publications/bulletins/nrb30/). Such a property that is eligible must be considered under Section 106; both properties eligible for the NRHP and not eligible for it need to be considered under NEPA. Please clarify.

EC6d-82, cont.

You are correct in saying that "(a)ssessing effects to these types of resources (TCPs) is typically accomplished through the consultation process," but the same can be said for all other types of historic properties. You seem to be making a distinction between TCPs and other kinds of historic properties that is not made in relevant ACHP or NRHP guidance. It is true that in Section 101(d)(6) of NHPA, Congress reminded agencies that "(p)roperties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the National Register" and directed that "(i)n carrying out its responsibilities under section 106 of this Act, a Federal agency shall consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to (such) properties," but this did not relieve agencies of their responsibility, clearly and repeatedly established in the Section 106 regulations, to consult with tribes and others in evaluating and addressing effects on all types of properties.

Your failure to address TCPs, including traditional cultural landscapes, in consultation with tribes and others is one of the core deficiencies in this DEIS/R. You are simply not free to ignore impacts on a whole class of historic property – particularly one about which tribes - including the Viejas Band - have expressed particular concern. Such willful ignorance, I believe, places you in direct violation of NHPA Sections 101(d)(6)(B) and 106, and seriously taints your compliance with NEPA and CEQA. Nor do you really have the option of putting off considering this class of property, and conducting such consultation, until after you make a permit decision. Section 106 and NEPA are designed to be complied with prior to making a federal decision. To propose to gather data, perform analyses, and conduct consultations that are central to compliance with the laws after you have made the decision to which the laws pertain stands their requirements on their heads.

EC6d-83

I suggest that you have two possible courses of action here:

1. Accept what the tribes are telling you about the significance of the overall landscape, agree to regard the whole landscape as eligible, and immediately undertake consultation with the tribes, the SHPO, other interested parties and the ACHP seeking to resolve adverse effects on it – including direct physical, visual, auditory and other effects, indirect effects, and this project's contributions to cumulative effects – and including off site alternatives to the OWEP; or

2. If you cannot bring yourselves to respect the tribes' position in this matter without validation from within your own cultural milieu, arrange for a study to be performed by a qualified, objective third party. Such a study should

seek to clarify what cultural and spiritual values the tribes attach to the landscape and relate such values to the National Register Criteria at 36 CFR 60.4 (all the criteria, not just Criterion D), with reference to pertinent professional and federal guidance, including at least National Register Bulletin 30 and Bulletin 38, as elaborated upon in my book, *Places That Count* (Altamira Press 2006) and other relevant professional literature. When this study makes it clear that the landscape is eligible for the Register as a TCP, as I am confident it will if properly conducted, then follow suggestion 1 above.

EC6d-83, cont.

Please clarify your intentions in this matter.

Comments on Section 4.4.3.1: "Direct and Indirect Effects" (Alternative 1: Proposed Action)

This entire section is fatally flawed by your atomizing approach to the recognition of historic properties. You apparently view the universe of such properties in the project area (or in the APE, or the ROI, however these are variously defined) as a sort of random collection of unrelated points in space, impacts on which can be avoided or mitigated through various kinds of project design and data recovery. What you do not seem to have considered, despite tribal efforts to prevail upon you to do so, is that the entire landscape within which the project is proposed is culturally significant and eligible for the National Register as a TCP. To say that you will mitigate effects on the area's historic properties by "avoiding" this one and recovering data from that one is like saying that you will mitigate the effects of throwing up a wind energy project in Old Town San Diego State Historic Park or the National Mall in Washington DC by making sure no turbines are located in the middle of historic structures and conducting archaeology on each turbine site. This appears to be a transparent attempt to minimize the project's apparent impacts and circumvent the requirements of NEPA, CEQA, and NHPA, among other authorities. Please reconsider this approach.

EC6d-84

You correctly observe that Indian tribes, including the Viejas Band, "regard the project site (sic: as part of a larger landscape) as a relatively pristine location with a high density of prehistoric resources (sic: tribes do not characteristically regard their historic places as "prehistoric") that should be considered as a whole cultural landscape or district," but you then proceed to ignore this stated tribal concern. Why have you not regarded the whole landscape as eligible for the National Register, or at least addressed this question in consultation with the tribes, SHPO, and other concerned parties?

EC6d-85

The regulations implementing Section 106, at 36 CFR 800.4(c)(1), require that an agency "apply the National Register criteria ... to properties identified within the area of potential effects that have not been previously evaluated for National Register eligibility," that it do this "(i)n consultation with the SHPO ... and any Indian tribe ... that attaches religious and cultural

significance to identified properties," and that the agency "acknowledge that Indian tribes .... possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance to them." The regulations go on at 36 CFR 800.4(c)(2) to say that "(i)f the agency official and the SHPO ... do not agree, or if the Council or the Secretary so request, the agency official shall obtain a determination of eligibility from the Secretary." There is no indication in the DEIS/R that you have done any of these things. Instead, you propose to continue consultation with the tribes about these matters as a mitigation measure, (CUL-9) after allowing the project to go forward. Somehow, you think (or say you think) that this will "ensure .... mitigation of any impact to traditional cultural places or other resources of Native American concern, such as sacred sites and landscapes, or areas of ceremonial uses."

EC6d-85, cont.

Translating what you propose into simple English, it appears that you are saying:

1. We are not going to do what the Section 106 regulations require us to do: consider the National Register eligibility of the landscape valued by tribes, as a basis for determining effects on it (and we hope that no one will notice that we are thus circumventing the law);

2. We are then going to go ahead and approve the project, subject to various conditions designed to reduce direct physical impacts to point-specific archaeological sites; and

3. We are going to keep talking with tribes about the sensitivity of their cultural landscape (without ever really acknowledging this sensitivity or seeing if it makes the landscape eligible for the National Register) while we let the applicant slice and dice the same landscape to put in its project.

EC6d-86

If this is not a correct rendering of what you propose, please explain why it is not. And please explain why you have not carried out the evaluative steps required by 36 CFR 800.4(c).

Considering the above fatal flaw of failing even to consider the relevant historic property subject to effect, the rest of this section is irrelevant. You cannot assess impacts on a resource whose existence you have not even effectively acknowledged. Please explain, if you can, why proceeding as you propose to proceed does not place the federal agencies in direct violation of Sections 106 and 101(d)(6)(B) of NHPA.

EC6d-87

Comments on Section 4.4.3.2: CEQA Significance Determinations

Considering that you propose to ignore the historic significance of the landscape within which the project is proposed, and to avoid compliance with the relevant regulations that would enable you to consider effects on it, it is obviously absurd (at best) to claim that construction of the project will "not result in a substantial adverse change" in the significance of a historic resource. It is patently obvious that this project will, if carried forward, result in

EC6d-88

substantial adverse changes. Cheerfully proposing to talk more with the tribes as the destruction proceeds (CUL 9) does not "mitigate" the adverse of this change.

EC6d-88, cont.

Comments on Section 4.4.9: Cumulative Impacts

Your statement that since, in your view, "the proposed action alternatives have been designed to avoid direct impacts to cultural resources from construction, operation, and decommissioning, the project is not expected to cumulatively contribute to direct impacts" is, of course, inaccurate at best. In point of fact, you do not even know what "cultural resources" are subject to direct or indirect impact, and have declined to undertake the actions necessary to find out. It is pointless to address cumulative (or other) impacts further based on such a flawed and incomplete record of the environment that is subject to impact.

EC6d-89

Comments on Section 4.4.10: "Mitigation Measures"

Since you have (thus far) avoided even identifying the affected resource, it is obviously impossible to design measures to mitigate impacts on it, so this section is meaningless. It should also be noted that none of these measures have been agreed to by the necessary consulting parties under NHPA Section 106. Most of the measures appear to be designed to provide remunerative employment to archaeologists (designing plans of various kinds, monitoring construction, etc.) and have nothing to do with actually addressing impacts on historic properties or "cultural resources" or the impacts to the tribal people who value them.

EC6d-90

Please withdraw this section until you have properly evaluated the eligibility of the landscape and completed the consultation required by the Section 106 regulations and by Section 101(d)(6)(B) of NHPA.

Comments on Section 4.22: "Irreversible and Irretrievable Commitment of Resources"

Why does this section fail to discuss even the commitment of narrowly defined archaeological resources to the project? Do you expect to grow new ones? Retrieve and replace the old ones once the project is decommissioned? Please respond to the premise that this project, if implemented, will require the irreversible and irretrievable commitment of a landscape that is eligible for the NRHP based on its cultural and historical significance to the Viejas Band and other Indian tribes.

EC6d-91

Comments on Section 4.23: "Short-Term Uses of Man's Environment and the Maintenance/Enhancement of Long-Term Productivity."

This section is a throw-away that provides nothing of the comparative analysis that should be found in a document of this kind. Please respond to the premise that this project, if implemented, will destroy a cultural resource (the historic/cultural landscape) that has existed for thousands of years and sustained the cultural values

EC6d-92

of the Viejas Band and other tribes, in order to achieve the short-term goal of producing energy that quite likely could be better, less expensively, and more quickly produced by pursuing one or more of the several alternatives you have declined to consider.

EC6d-92, cont.

Comments on Section 5.5.5: "NHPA Section 106 Compliance"

Section 106 requires not just that an agency "evaluate the effect of the proposed project" on historic properties, but that it take this effect into account – in other words, think about it. The Section 106 regulations at 36 CFR 800 spell out how this is to be done, and critically emphasize that it is to be done "through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning" (36 CFR 800.1(a)). This section must be evaluated with this standard in mind.

What are the "recent amendments to the regulations" to which you allude? The regulations were last seriously amended something over ten years ago, at which point, as you indicate, requirements for tribal involvement were strengthened. You say that "Any adverse effects that the Proposed Action or alternatives may have on historic properties would be resolved through compliance with the terms of a Memorandum of Agreement (MOA)." How do you know this? You do not appear even to have initiated consultation under Section 106, so how can you be sure that when you do, it will result in an MOA?

EC6d-93

Your description of the Section 106 review process leaves out a critical step. 36 CFR 800.3(c) requires that agencies begin the process by identifying and initiating consultation with the State Historic Preservation Officer (SHPO), while 36 CFR 800.3(e) requires that the agency plan to involve the public and 36 CFR 800.3(f) requires that the agency identify other consulting parties. Why have you not discussed how you have undertaken these critical first steps? Please enlighten us as to how they have been undertaken.

Having thus initiated consultation, and consulted to establish the scope of identification (36 CFR 800.4(a), then as you say, "(p)roperties within a project's area of potential effect (APE) are identified with input from the State Historic Preservation Officer (SHPO), Indian tribes and other consulting parties, and evaluated for eligibility to the NRHP in consultation with the SHPO." You say that "(c)onsultation with the SHPO about this project, the inventory status, and survey methodology was initiated on March 22, 2011." This is interesting but not indicative of much effort to comply with Section 106. Who else are you consulting with?

With whom did you consult about the scope of identification? What were the results of this consultation? You apparently have proceeded to conduct archaeological surveys, but is this all you were advised to do? How did you arrive at this scope of work? What has happened in Section 106 review since March 22, 2011? It appears

that you are still in the process of identifying historic properties that may be subject to effect; is this correct?

EC6d-93

You say that "(t)he BLM has not yet made its findings of effect for this project as consultation is still ongoing." Consultation with whom? How can you make findings of effect when you have not yet completed identification?

EC6d-94

Finally, you say that "(t)hrough consultation with the SHPO, Indian tribes, other consulting parties, and the ACHP, if they elect to participate in Section 106 consultation, BLM will seek to resolve potential adverse effects of the proposed undertaking through a MOA or Programmatic Agreement (PA)." From all this it appears that:

1. You have barely initiated Section 106 review, consulting with no one but the SHPO;
2. You have conducted some identification work, but have not completed identification, and have not yet consulted about the effects of the project;
3. You have not initiated consultation about how to resolve any adverse effects; yet
4. You expect to execute an MOA or PA that will allow you to approve the project.

EC6d-95

Do you have any basis for this expectation besides wishful thinking? Do you plan to complete Section 106 review before making a project approval decision? Why do you think the other consulting parties (notably tribes) will agree to an MOA or PA? What are your plans if they do not?

Comments on Section 5.2.3: "Tribal Consultation"

You report a number of activities that you believe constitute tribal consultation, and you outline some of the major concerns that tribes have expressed about this project and its effects on the culturally valued tribal landscape. Do you propose to do anything about these expressions of concern? If so, what? Do you think that "consultation" is adequate if it elicits expressions of concern and then nothing is done to address those concerns? If not, what do you propose to do regarding tribal concerns? Do you think you have completed tribal consultation?

EC6d-96

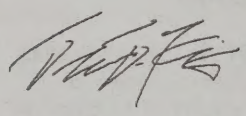
In conclusion: this DEIS/R would be a joke if it were not so clearly designed to masquerade as an actual analysis of environmental impacts and provide political cover to the agencies' already-made decision to approve this project. NEPA, CEQA, and Section 106 of NHPA are designed to be planning tools, not vehicles for post-hoc rationalizations of decisions already made. Providing renewable energy is important; it should not be delayed and complicated by the kind of non-planning and dishonesty

EC6d-97

reflected in this DEIS/R. Please withdraw this unfortunate document and prepare a meaningful analysis consistent with the relevant laws and regulations.

EC6d-97, cont.

Sincerely,



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Training, writing, consultation, dispute resolution in cultural resource & heritage management, environmental impact assessment

November 15, 2011

Mr. James Kenna, State Director
Bureau of Land Management
2800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Subject: Comments on Draft Archaeological Survey Report for the Ocotillo Wind Energy Project (OWEP), Imperial County, California

Dear Mr. Kenna:

I am writing to comment on the above-referenced archaeological survey report, dated October 2011 and prepared by Tierra Environmental Services. Like my overall comments on the OWEP DEIS/R, I have prepared this comment at the request of the Viejas Band of Kumeyaay Indians (Viejas), and as part of Viejas' comments to you on the subject OWEP DEIS/R. As part of this review I also examined an associated osteological report and project area maps prepared (I presume) by Tierra.

Background: In an appendix to my comments on the DEIS/R, I outlined my general qualifications for commenting on such documents. With specific reference to archaeological reports like this one I should highlight the facts that:

- Between 1972 and 1976 I conducted several archaeological field projects in the California Desert;
- My PhD in anthropology from the University of California, Riverside emphasized archaeology;
- I participated in the creation of the Society for California Archaeology, and in developing its guidelines for archaeology under the California Environmental Quality Act (CEQA);
- I participated in drafting the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation,* and related regulations and guidance;
- I am the author of Doing Archaeology: a Cultural Resource Management Perspective (Left Coast Press 2005, and (with Gregory White), *The Archaeological Survey Manual* (Left Coast Press 2007).

Introduction: In general, I find this report puzzling and troubling. At best it appears to reflect considerable misunderstanding of archaeology's relationship to the environmental and historic preservation laws with which the federal agencies involved in the OWEP must comply. At worst, it may represent a deliberate effort to obfuscate this relationship in such a way as to present the agencies as being in compliance with the law when in fact they are not. Giving the authors the benefit of the doubt, most of my comments, below, are phrased in terms of questions, whose answers may elucidate what the authors actually understood their task to be.

Comment 1: The regulations implementing Section 106 of the National Historic Preservation Act (NHPA) require, among other things, that agencies make a "reasonable and good faith effort" to identify historic properties subject to effect by their undertakings (36 CFR 800.4(b)(1)). This effort is to be carried out after, and based on, a process of scoping in which the agency establishes the undertaking's area of potential effects (APE), reviews existing information on the area, seeks information from interested parties, and gathers information from any Indian tribe that may ascribe cultural or religious significance to the area (36 CFR 800.4(a)). The effort "may include background research, consultation, oral history interviews, sample field investigation, and field survey." As a threshold matter, reviewing this report with reference to the above standard requires answering two questions that are, as far as I can tell, answered nowhere in this report or in the draft environmental impact statement/report (DEIS/R) that it presumably informed:

1. How does Tierra's archaeological survey relate to the "reasonable and good faith effort" to identify historic properties that BLM is required to undertake? Assuming this is an adequate archaeological survey report, what has BLM done to identify non-archaeological historic properties, notably cultural landscapes and traditional cultural properties?
2. Was the plan for this survey based on the scoping activities required by 36 CFR 800.4(a)? If so, these should be described – if not in this report, then elsewhere in the administrative record, and this description should be available for public review.

EC6e-01

Comment 2: On page iv we are told that about two different areas of potential effect (APEs): a "direct impact APE" and an "indirect impact APE." Neither seems to have embraced areas where the Ocotillo Wind Energy Project (OWEP) may have visual, auditory, or other effects on historic properties. Have other APEs been defined within which studies have been or are being done to address such effects?

EC6e-02

Comment 3: Beginning on page iv, the report seems to use the terms "archaeological resource" and "cultural resource" interchangeably. Similarly, the terms "archaeological survey" and "cultural resource survey" are both used. None of these terms are defined. Since it is important to understand what the

EC6e-03

researchers who conducted this survey were actually looking for, these terms need to be defined, as does the relationship between them. "Archaeological resource" is, of course, defined in regulations implementing the Archaeological Resources Protection Act (ARPA); is this the definition used here? "Cultural resource" is defined nowhere in law or government-wide regulation and is used in a variety of ways in the professional literature. What definition is employed here, and how does it relate to the term "archaeological resource?" And what is a "cultural resource survey" as opposed to an "archaeological survey?"

EC6e-03, cont.

Comment 4: What is meant by "100 percent coverage?" 100 percent of what? Covered by what?

EC6e-04

Comment 5: What systems were employed to ensure "(d)etecting all prehistoric and historic archaeological resources in the Project area?" I should note that I have never met a responsible archaeologist who was sure that he or she had detected all such resources in any area. What gives Tierra such confidence?

EC6e-05

Comment 6: What are the "highest contemporary standards" that guided documentation? Please cite them and show how Tierra met them.

EC6e-06

Comment 7: What is "the regional research context?" In my experience research is highly researcher-dependent. Whose "context" are we to consider here?

EC6e-07

Comment 8: Although members of local Indian tribes took part in the survey, presumably as living people, the association of the Kamia and Kumeyaay with the area is discussed entirely in the past tense. Were the authors unaware of contemporary Kumeyaay associations with the area, or were these simply not regarded as relevant?

EC6e-08

Comment 9: On page 2-13 and elsewhere, what is an "isolate?" What is a "site?"

EC6e-09

Comment 10: Per page 2-13, why can "a dearth of information...not be substantiated in the field?"

EC6e-10

Comment 11: Per page 2-13, why does it follow that because the anonymous recorder of "sites" from the GLO records "did not ground truth them, but used only the written notes," the information (as opposed to its dearth) "cannot be substantiated in the archaeological record nor relocated in the field?" If the anonymous recorder wrote, on whatever basis, that there was a "site" of some kind at Location X, is it not at least theoretically possible that if one revisited Location X today one would find a "site?"

EC6e-11

Comment 12: Upon what basis were judgments about "NRHP Eligibility" (which I presume means eligibility for the National Register of Historic Places) made in preparing Table 2.2? Does this represent the judgment of the original recorder, or the present authors? What does "not eligible" mean vis-à-vis "recommended not eligible?" **EC6e-12**

Comment 13: On page 2-21, the authors appear to take it as given that the ascriptions of eligibility and ineligibility for the NRHP made by the original recorders were correct. Is this in fact their assumption? Is so, why? **EC6e-13**

Comment 14: Per page 3-2: Why is it that "(t)he vast majority of archaeological sites which do qualify for listing in the NRHP do so under Criterion D, (for) their research potential?" Do the authors take this to be a characteristic inherent in the sites (whatever they understand to be "sites")? Is not the comparison of properties to criteria something that goes on in the heads of evaluators? Is it not the case that the vast majority of people who evaluate archaeological sites are archaeologists, whose interests are primarily in research? To what extent is it likely that sites in the area have been judged "significant" and "not significant" based more on the interests and biases of their evaluators than on anything intrinsic to the sites themselves? **EC6e-14**

Comment 15: Also per page 3-2: Does not the fact that "(m)uch of what an archaeologist can learn from an archaeological site derives from the interrelationships among artifacts, ecofacts, features, and so forth" apply to relationships between and among "sites" as defined by archaeologists, as well as to relationships within them? If this is the case, then is it legitimate to evaluate individual "sites" in isolation from one another, and from the landscape within which they lie? Would it not be more reasonable, even on wholly archaeological grounds, to evaluate sites in landscapes as suites or ensembles? Would such an approach perhaps result in a different evaluation of significance and eligibility/ineligibility for the NRHP? **EC6e-15**

Comment 16: On page 3-3, the statement that "(a) site that meets these qualifications (association with traditional beliefs, customs, or practices) and has been evaluated as eligible to (sic) the NRHP may also be evaluated as a TCP" (sic: traditional cultural property) is not correct and in fact is precisely backward. A site (or any other kind of property) that is associated with traditional beliefs, customs, or practices, and valued by people as such, is ipso facto a TCP. If it meets the National Register Criteria (which it may do based on its traditional cultural significance) then it is eligible for the NRHP. Being a TCP is a condition precedent to being eligible for the NRHP (like being a Queen Anne home or a Romanesque church); it is not dependent upon NRHP eligibility. But since no effort is made here to consider whether the sites **EC6e-16**

identified represent TCPs individually or collectively, why is this discussion even included in the report? **EC6e-16, cont.**

Comment 17: Having offered so much discussion of the NRHP criteria and eligibility, the authors say nothing to apply this discussion to the case in point. What is the purpose of all the discussion on pages 3-2 and 3-3, other than to fill space? **EC6e-17**

Comment 18: On what basis can the authors be so sure, on page 3-3, that "all cremation sites within the Project area will be strictly avoided?" Avoided by what? Is it certain that all such sites have even been identified? If so, what is the basis for such certainty? Are cremation sites so easy to identify? Are they never buried? Obscured by brush? So diffuse as to blend in with the desert pavement and sands? **EC6e-18**

Comment 19: Per page 3-3, why would "NAGPRA only be invoked in the event of an inadvertent/unanticipated discovery of human remains?" Are the authors unaware that under 43 CFR 10.5 an agency must "invoke" NAGPRA when it "becom(es) aware of a... planned activity that... may result in the ... inadvertent discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony on Federal lands" (43 CFR 10.5(b))? That the agency must identify and consult with lineal descendants and culturally affiliated tribes, and ultimately develop a plan of action for addressing such inadvertent discoveries should they occur (43 CFR 10.5(e))? Are the authors and BLM not aware that (a) NAGPRA is about more than human remains (It also involves funerary objects, sacred objects, and objects of cultural patrimony) and that (b) it requires planning, consultation, and consideration in anticipation of discoveries, not just waiting around until such discoveries occur? These are quite specific federal regulatory requirements, issued by the Department of the Interior; does BLM propose simply to ignore them? **EC6e-19**

Comment 20: Per page 3-3, Sec. 3.2, why does Tierra say it is necessary to put prehistoric and historic site date "into a regional research context" in order "to be useful to land management?" How does Tierra understand the relation of a site to a research context to affect its management? **EC6e-20**

Comment 21: Per the same section, while it is arguable that "(k)nowing the regional research issues plays a critical role in evaluating sites for significance and eligibility for listing in the NRHP" under National Register Criterion D (36 CFR 60.4), Tierra seems to be ignoring eligibility under Criteria A through C. Although the authors include a throw-away line about evaluating sites "under all the eligibility criteria," there is no evidence that this has been done. Where are these sites, individually or collectively, evaluated with reference to National Register Criteria A through C? **EC6e-21**

Comment 22: At the bottom of page 3-4, the report assures us again that Pattern Energy has designed the project "to avoid known cultural resources." This would be a comforting assurance if it were believable. In fact, comparing the maps of site distributions with the maps of proposed lines of wind turbines, the assurance appears to be merely an obfuscation. Note, for example, that in the DEIS/R we are assured that the project has been redesigned to avoid not only the Spoke Wheel Geoglyph, IMP-6988 (a property included in the NRHP, with specific reference to the significance of its viewshed, that is used today by Kumeyaay people for spiritual purposes) but its significant viewshed to the east (We are not told whether viewsheds to the north, south, or west are significant or what has been done about them). With site distribution maps and maps of proposed turbine locations now in hand, it is apparent that while a line of turbines that would have passed directly through the geoglyph seems to have been removed from the plan, there is a line of turbines about ½ mile directly to the east of the site, and over six more lines further to the east. How can this be defined as "avoiding" impact?

EC6e-22

Comment 23: Section 3.2 goes on, on pages 3-5 through 3-8, to provide a laundry list of research topics that might be addressed using the sites threatened by the project. How this will be done when most such sites will ostensibly be "avoided" or are not eligible for the NRHP remains something of a mystery. It is also a mystery how these topics, and not others, were selected to examine. Notably, the topics are all essentially descriptive: what's the chronology, what did people eat, where did they live, how did they flake stone, what kind of trade did they engage in, what were their religious beliefs? Is there nothing to be learned from this complex of sites/landscapes that bears on larger issues like climate change and its effects, or the existence and impacts of changing sociocultural/socioeconomic systems through time?

EC6e-23

Comment 24: Section 3.3 again distinguishes between a "Direct Impact APE" and an "Indirect Impact Ape." How were these distinctions made? By whom? On what bases? Was anyone else – notably tribes and the SHPO – consulted? If not, why not?

EC6e-24

Comment 25: On page 3-9, again, what is the basis for regarding visual impacts as "indirect" impacts? Do they not take place at the same time as the undertaking, and in the same location, albeit extending into the future and to greater distances? But what are greater distances? What is the "location" of this project? Does Tierra understand it to be the project area, or the points on which individual turbines will be installed and service roads built?

EC6e-25

Comment 26: Under Section 3.4, "Field Methods," why was the transect interval set at 15 meters (about 49 feet?) This presumably means that each archaeological pedestrian scanned an area of 7.5 meters (about 24.5 feet) to either side as he or she walked across the landscape. In this area he or she was

EC6e-26

expected to discern such phenomena as potsherds, flakes, and small clusters of cremated bone. Is this a realistic expectation? If so, why? **EC6e-26, cont.**

Comment 27: How were the boundaries of "archaeological sites" defined? What was the basis for recognizing them? To what extent does Tierra think this definition reflects cultural reality as opposed to arbitrary archaeological choice? **EC6e-27**

Comment 28: The distinction between "archaeological site" (three or more artifacts within 50 (square?) meters, with or without an associated feature), and "Isolate" (two or more artifacts without an associated feature) seems arbitrary and vanishingly small. What would happen to the report's analysis if Tierra defined all the expressions of past human activity in the area as "sites?" **EC6e-28**

Comment 29: On what basis were sites defined as "knapping station", and on what basis was it determined that "little additional scientific value was being added" by their rigorous recording? What does Tierra understand to be "scientific value?" Was anyone consulted in deciding to sample these features/sites, and to reduce the level of their recordation? What effect might this change in documentation strategy have on the use of the sites and features for scientific research? **EC6e-29**

Comment 30: There is no evidence that the "sites" and "isolates" were considered together in any way, to define larger clusters, districts, and landscapes. It seems likely that a more holistic consideration of the phenomena could yield a different evaluation of research value, significance, and NRHP eligibility. Please explain why Tierra has not aggregated sites and isolates into larger phenomena like districts and landscapes, and evaluated these? **EC6e-30**

Comment 31: Section 3.6's assurance that "(r)egional Native Americans" participated in the field survey is welcome, but constitutes no substitute for government-to-government consultation with tribal governments, or for engaging Native American interests in planning and decision making as required by Sections 106, 101(d)(6)(B) and 110 of NHPA, by NAGPRA, and by such more general authorities as AIRFA and Executive Orders 13007 and 13175. Has such consultation been undertaken? If so, where is the evidence for it, and how does it relate to the use of "regional Native Americans" on survey teams? Were these participants selected by tribes, or simply hired by Tierra off the street? **EC6e-31**

Comment 32: The site typology in Section 3.7 generally looks reasonable and well thought out, but it does raise some questions, outlined below. **EC6e-32**

Comment 32a: The category "artifact scatter" seems to embrace quite a range of phenomena and to overlap several of the other categories. Does it perhaps

need to be eliminated in favor of its functional subtypes? Should some of these be merged into other site types?

Comment 32b: Is "agave procurement site" a misnomer? As described, these sites appear to be agave processing sites, or at least their physical features reflect agave processing, not procurement. Did not procurement take place on lands surrounding the sites as you have defined them? Does this suggest that the boundaries of agave procurement sites should be expanded beyond what is archaeologically observable as evidence of agave processing?

Comment 32c: The mention that campsites "within a dune formation often contain subsurface materials" is important in terms of the notion that all cremation sites can be "avoided." Campsites presumably sometimes contain cremations (people do sometimes die at camp). If these get buried in dunes they are presumably invisible to surface surveyors. Accordingly, is it not inaccurate and risky to propose that all cremations can be "avoided?"

EC6e-32, cont.

Comment 32d: Is it reasonable to lump "pot drops" and the probable remains of urn burials into the same category ("ceramic scatters")? Does this not semantically downgrade the importance of possible urn burials? Would it be better to divide this category into its functional subcategories?

Comment 32e: The discussion of trails on page 3-13 rightly stresses their spiritual significance to tribes. This being the case, does it make sense to evaluate trails, and the landscapes they cross, solely under National Register Criterion D?

Comment 32f: The discussion of geoglyphs on page 3-14 oddly fails to give specific attention to the Spoke-Wheel Geoglyph within the proposed project area, IMP-6988, which (with specific reference to its viewshed) is already included in the NRHP. Do the authors have anything to say about this geoglyph? Are others noted in the project area comparable?

Comment 33: Accepting the general accuracy of the site-counts given under Section 4.1, "Survey Results," but also noting that these counts result from what amounts to a sample survey of transects keyed to proposed construction areas, can the authors make any projections about the total number of sites of different types in the whole project area? In the larger APE or "Region of Influence?"

EC6e-33

Comment 34: As noted above and elsewhere, referring to the sites in isolation, rather than relating them to one another and to the natural features of the landscape, may be misleading, and certainly fails to convey an appreciation for the sites as reflections of past and contemporary human uses of the landscape. Would it not be useful, and more likely to reveal aspects of research potential

EC6e-34

(perhaps among other values), to look at the sites and isolates in context, as aspects of the overall landscape?

EC6e-34, cont.

Comment 35: At the bottom of page 4-5 the authors say there are four sites within the project area that contain what appear to be human cremations. Dr. Hinkes' osteology report, however, appears to document the presence of at least five human cremations within the project area, at four labeled archaeological sites and on/in the "Southwest Dune." On page 4-6 the authors say that the Southwest Dune has "not been formally documented as the Project applicant has redesigned the project to totally avoid all impacts to this site." Please see above comments on these putative "avoidance" situations. And if the authors are going to leave substantial identified sites out of their analysis simply because they have the applicant's promise to "avoid" them, does this not seriously impair Tierra's ability to interpret the total suite of sites within the APE?

EC6e-35

Comment 36: Though Dr. Hinkes is conservative in her assignments (using terms like "most likely human" and identifying something as "definitely human" only when she has a clearly diagnostic fragment), it is a fact that the remains of human cremations in the desert tend to be quite distinctive, and quite heavily reduced by burning. Her descriptions are consistent with those of cremations I have observed and recorded elsewhere in the California Desert, and I see no reason to question her judgments.

The survey maps are at such a small scale that I cannot identify the site numbers, which would give me an idea of how these cremations are distributed over the project site. It would be helpful to be able to do this, to see whether there is an area (or areas) where cremations tend to cluster. It appears from the text on page 4-6 that there may be some tendency toward clustering in the southwest part of the project area, though cremations are reported there and in the northeast and northwest quadrants as well.

EC6e-36

There is also no reason to assume that the cremations recorded are the only ones that occur in the area (See comments above). Tiny fragments of calcined bone are relatively easy to miss in the course of doing an archaeological survey (especially on 15-meter transects), and often tend to get buried even where soil deposition is relatively spotty, to say nothing of dune situations. In fact, by enriching the soil, a cremation may contribute to vegetation and soil development in areas where they are otherwise limited, thus tending to disguise themselves. There may, in short, be many more cremations in the project area than those recorded here. What Dr. Hinkes' report shows unequivocally is that human remains, which BLM must address under the Native American Graves Protection and Repatriation Act (NAGPRA) as well as under NHPA, CEQA, and NEPA, do occur in the project area and are subject to possible disturbance.

Comment 37: The authors' statement that "(i)t must be emphasized that these four sites contain the only archaeological evidence that could reasonably be construed as

EC6e-37

human remains in the survey area" is a classic example of hubris, and of protesting too much. Tierra has conducted a partial archaeological survey of the project area, limited to surface inspection of selected tracts on 15-meter transects. No responsible archaeologist would assert that he or she had thus identified, with certainty, all the examples of any phenomena – particularly phenomena as hard to see and easily obscured as the remains of cremations in dune fields.

Please also explain what is meant by "burial ground." The Free Online Dictionary defines "burial ground" as "a tract of land used for burials." Is not the project area a tract of land? Is not a cremation a burial? Did not someone have to use the project area for cremations in order for the cremations to be found there? Please also note that NAGPRA does not require the protection of "burial grounds," but of any ancestral human remains, funerary objects (like ceramics associated with cremations), sacred objects, and objects of cultural patrimony. The authors' statement appears to be a transparent attempt to convince the reader that human remains are really not "a problem," based on data that suggest no such thing. In a nutshell, the statement appears designed only to obfuscate the record in service to the applicant's interests.

EC6e-37, cont.

Comment 38: The first sentence of the fourth paragraph in the description of CA-IMP-008 appears to be incomplete. What can the authors infer "based on the landforms on which it is situated" – that subsurface cultural materials exist, or that they do not?

EC6e-38

Comment 39: Why is the prehistoric component of site CA-IMP-008/H recommended as eligible only under Criterion D? Does Tierra not take what appears to be some thousands of years of site use in the production of stone tools to represent association with significant events in the past that may make the site eligible under Criterion A? Does Tierra not see the site as representative of a type, and hence possibly eligible under Criterion C? Here and elsewhere, why is Criterion D the only criterion the authors seem able to apply?

EC6e-39

Comment 40: The fixation on National Register Criterion D permeates all the site evaluations, and is particularly striking in the case of CA-IMP-6988, the Spoke Wheel Geoglyph. Here, even though the site was not only determined eligible for but formally listed in the NRHP in 2003 under both Criteria C and D, the authors cannot seem to bring themselves to acknowledge anything but its research potential. It is also notable that they ignore the documentation in the NRHP nomination that emphasizes the importance of the view from the site.

EC6e-40

(Note: I have not examined the rest of the site descriptions in detail. Aside from their fixation on the letter D, and the fact that they view each little "site" in isolation from all others rather than considering relationships among them in the landscape, I have no basis for questioning their accuracy at the present time.)

Comment 41: Re. the discussion of "lithic scatters" beginning on page 5.1, please see Comment 32a above. **EC6e-41**

Comment 42: Re. the discussion of "Agave Procurement Sites" on page 5-2, please see Comment 32b above. **EC6e-42**

Comment 43: Re. the "Prehistoric Research Hypotheses" set forth beginning on page 5-4, please see Comment 23 above. **EC6e-43**

Comment 44: Chapter 6 is fatally flawed by the authors' inability to understand significance in any but research-based NRHP Criterion D terms, and by their insistence on atomizing the area's historic resources into discrete bits, rather than looking holistically at how these bits relate to one another and the landscape within which they exist and for which they are significant to contemporary tribes. This entire chapter needs to be reworked to consider the "sites" and "isolates" as components of a landscape that may be eligible for the NRHP under at least Criteria A, C, and D. **EC6e-44**

Comment 45: The first full paragraph on page 6-11 refers to something happening "(d)uring the Section 106 consultation process," but as documented in the DEIS/R, there has not yet been a Section 106 consultation process. No such process is documented in this report. Please clarify. **EC6e-45**

Comment 46: This paragraph goes on to say that consideration of an "archaeological district" is warranted only "when a high density of potentially eligible sites are under consideration for listing in the NRHP." What is the basis for this assumption? Why, for example, could not a large area containing many isolated artifacts reflecting a particular kind of land use not be classified as an "archaeological district?" The paragraph goes on to throw in terms like "unusual" and "unique" that have nothing to do with NRHP eligibility, and to allege that a "geographic boundary" – ostensibly not definable in this case although there is no evidence that anyone has tried – is necessary to establish a district. This is certainly not true, as the Keeper of the National Register discussed recently in establishing the National Register eligibility of Nantucket Sound. Finally, it should be noted that whatever an archaeologist may think about the legitimacy of calling the area an "archaeological district," it remains to be evaluated as an historic district in accordance with NRHP procedures, based on its status as a traditional cultural property and/or a cultural landscape. The statement here appears to be a transparent effort to denigrate the overall significance of the landscape based on the narrow perspectives of one contract archaeology firm's formulation of archaeological research questions, and Tierra's questionable understanding of NRHP guidance. **EC6e-46**

Comment 47: The statement that "much more information than is currently available on specific sites" is needed and can only be obtained through "excavation and more detailed analyses" appears to be an equally transparent effort to squeeze more money out of the project proponent. **EC6e-47**

Comment 48: Where do the authors get the idea that "TCPs ... must exhibit long term use or sustained awareness by the community," and why do they think that the area containing the sites they have recorded doesn't meet these putative standards? National Register Bulletin 38 on TCPs says nothing about "long term use," or "sustained awareness by the community," and there are many cases in which to impose such standards would be flatly discriminatory. The dominant (white) culture has dispossessed tribal people off the land on which their traditional places lie; Tierra now proposes that if they have been unable to "use" such lands over the "long term," they cannot value them? That they cannot value them if they have not sustained an awareness of them despite dispossession, relocation, and exclusion from them? Please review the professional literature on TCPs and reconsider this position, which borders on racism. Please also consider actually consulting the people who value the landscape, as National Register Bulletin 38 proposes and Section 101(d)(6)(B) of NHPA requires, before reaching conclusions about what is and is not a TCP.

Elaborating on the above point for general reference, please see my blog posting of 11/1/11 at http://crmplus.blogspot.com/, which goes as follows

I'm reviewing a report on an area's "cultural resources" (by which the authors seem to mean archaeological stuff, with an occasional bow to old buildings), prepared in connection with an environmental impact assessment of a proposed land use project. Toward its end, as something of an afterthought, the report talks a little about whether the landscape within which lie the hundreds of "archaeological sites" it's described might be a "traditional cultural property" (TCP) that's eligible for the National Register of Historic Places.

EC6e-48

The report was prepared by contractors working for the private company that proposes to build stuff all over the subject landscape, so predictably (given sad current practice) its authors do everything they can to downplay the area's cultural significance – except to some extent the research significance of the "archaeological sites," which they can be paid to dig up as "mitigation." So, despite pretty vehement representations by tribes that value the landscape (and without consulting the tribes, the SHPO, or apparently anybody else), they say nope, it's not a TCP.

Why? Because, they say:

TCPs ... must exhibit long term use or sustained awareness by the community.

In other words, if the relevant community hasn't "used" the property over the "long term," and/or maintained some kind of unspecified "awareness" of it, the property is not a TCP.

Now, in this particular case it's notable that nobody seems to have asked the tribes whether and how they "use" the landscape in question, or what "awareness" they have of its cultural significance (Archaeologists, after all, are experts, so they must just know this stuff through osmosis or something). In fact there are good reasons to think that tribal members are well aware of the landscape and its cultural character, and use it for both spiritual purposes and the education of youth. But never mind the particulars: does it make sense to say, in principle, that a community must continue to "use" a place, or be "aware" of specifics about it, in order for it to be a TCP, and eligible for the National Register as such?

Continuing Use

National Register Bulletin 38 (http://www.nps.gov/nr/publications/bulletins/pdfs/nrb38.pdf), which (like it or not) is the National Register's official word on the subject, says:

The fact that a property may have gone unused for a lengthy period of time, with use beginning again only recently, does not make the property ineligible for the (National) Register.

The Bulletin goes on to posit a situation in which a group revered a particular mountain in the past, but then was forcibly relocated to someplace where it could not readily access the mountain, and coerced into a religious conversion that caused them to ignore the mountain's spiritual significance. It goes on to imagine the group now undergoing a cultural revival in which it seeks to reconstruct its relationship with the mountain, and concludes:

The fact that the contemporary use of the peak has little continuous time depth does not make the peak ineligible; the peak's association with the traditional activity reflected in its contemporary use is what must be considered in determining eligibility.

So you don't have to have "continuing use," and let me add that it would be especially ironic (to put it mildly) for the federal government – which for many decades pursued policies of disconnecting tribes from their traditional religions and lands – to insist on "continuing use" as a prerequisite to recognizing a place's cultural significance.

Sustained Awareness

But does the tribe or other group not at least have to be *aware* of the place in order for it to be significant? We didn't think about this one in writing Bulletin 38, but it soon came up in practice, and I discussed it on pages 256-7 of *Places That Count*, my 2006 book on TCPs (http://www.amazon.com/Traditional-Cultural-Properties-Resource-Management/dp/0759100713). As an example I looked briefly at Hopi and Zuni beliefs that their ancestors traveled all over the Southwest after their emergence into this world, guided, facilitated, and impeded by supernatural forces. The Hopi and Zuni have said that wherever their ancestors left evidence of their passing, that's a TCP. They don't know where all those places are, but they know them when they see them. Similarly, I quoted from an Australian case in which an aboriginal expert from one part of the country was able to recognize a place in an area he had never before visited, because of the way it is described in a traditional story, and thus know that (a) it was associated with a moiety not his own and (b) it was to be respected as such.

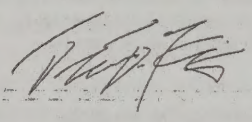
Clearly, a Hopi or Zuni elder cannot be said to have had "sustained awareness" of, say, archaeological site AZ-CIB-666P5 (if there is such a place), which he or she has never seen. But he or she knows that such places – with particular kinds of potsherds and masonry – are associated with the ancestors, and he or she knows that if he or she *does* visit it, there are things to be done to show respect – prayers, maybe an offering – and that one ought not mess the place up if one can help it. The aboriginal expert in the Australian case knew that there were things to do – maybe recite from a song, maybe refrain from picking things up – to respect the ancestral spirits of the moiety associated with the hitherto unvisited place. Are these associations sufficient to make such a place eligible for the National Register? I think so, though perhaps reasonable people can disagree. But surely it is clear that the mere fact that the Hopi don't know precisely where each site associated with the ancestors is and what it looks like does not automatically make such sites ineligible for the Register; still less does it render them "not-TCPs."

Unfortunately, the "continuing use" and "sustained awareness" criteria seem to be slipping into the practice of identifying (or trying hard not to identify) TCPs – spurred by the desire to avoid recognizing and dealing with such properties and to facilitate the projects of those who pay us CRM practitioners to make ostensibly objective and authoritative studies. If you want to use these criteria to help your client run roughshod over the cultural environment, that's up to you, but please don't pretend that you're reflecting some widespread best practice or government guideline.

EC6e-48, cont.

Comment 49: Page 6-12 is mostly made up of special pleadings on behalf of Pattern Energy. Understanding that Tierra works for and is paid by Pattern Energy, can its employees not at least make some effort to appear objective in their analysis? On the other hand, perhaps it is just as well that they do not; Tierra's sensitive attention to its client's interests makes it clear that its observations and conclusions cannot be trusted to represent anything but those interests.

EC6e-49



Comment Letter EC6f

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Training, writing, consultation, dispute resolution in cultural resource & heritage management, environmental impact assessment

November 15, 2011

Mr. James Kenna, State Director
Bureau of Land Management
2800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Subject: Ocotillo Wind Energy Project (OWEP); Draft Environmental Impact Statement/Report (DEIS/R): Confidential Appendix G, "Tribal Consultation."

Dear Mr. Kenna:

Like my overall comments on the OWEP DEIS/R, I am writing this letter at the request of the Viejas Band of Kumeyaay Indians (Viejas), and as part of Viejas' comments to you on the subject OWEP DEIS/R.

This appendix is titled "Native American Consultations and Concerns," and is cited in the DEIS/R as evidence that BLM and the other federal agencies involved with the OWEP are engaging in good-faith consultation with Indian tribes, including Viejas, as required by law, regulation, executive order and presidential memorandum. Unfortunately, the appendix evidences no such thing.

The appendix does not document any consultations with Indian tribes by BLM, or any other federal agency. It documents information that Tierra Environmental Service, under contract with Pattern Energy, collected from individual tribal members and alleged tribal members in the course of their archaeological fieldwork on the project. Some of the concerns expressed by these individuals seem to coincide with the concerns expressed to me by Viejas, but be this as it may, this appendix simply has nothing to do with the government-to-government tribal consultation in which BLM is required to engage.

EC6f-01

That said, there are a few items in the appendix worth highlighting.

1. Page 1, paragraph 3. Tierra apparently has its own definition of "tribal elder." It may be worth noting that tribes define eldership in many ways, and it is not up to either federal agencies or consultants for project proponents to impose their own definitions.

EC6f-02

2. Page 1, paragraph 5. Note the expressions of concern by informants about cremations. This is consistent with concerns expressed by Viejas. Pattern proposes that it has somehow "avoided" all cremation sites; I think a fair review would show that Pattern has no idea even where all the cremation sites are, and quite likely that substantially more sites exist in the area. **EC6f-03**

3. Page 2, paragraph 2: Note that "(a) number of Kumeyaay consultants, site visitors, and tribal representatives expressed concern about a lack of explicit and efficient communication between consultants and Kumeyaay tribal governments." There is no indication that anything was done about this, and indeed, Tierra would have been hard pressed to do anything. Tribal consultation is a BLM responsibility, and in my experience BLM (and many tribal governments) discourage consultants from engaging in such consultation. But if BLM is not going to do it either (and ample evidence suggests it is not), it means that no one is talking with the tribes about their concerns. **EC6f-04**

4. Page 3, first full paragraph: Tierra says that "all sites with possible cremations were visited by a highly qualified anthropological osteologist." This is at best an expression of unsustainable hubris on Tierra's part; no archaeologist worthy of the name will guarantee that he or she has found all sites of any kind in an area like that proposed for the OWEP. What Tierra means is that all sites that Tierra found that appeared to Tierra to contain possible cremations were visited by an osteologist. How many more sites containing cremations may be on the property, either missed by the archaeologists or invisible to them because of drifting sand, vegetation, or other obscuring factors cannot be known. **EC6f-05**

5. Page 3, second full paragraph. A technical point, but one that goes to Pattern's apparent effort to downplay the significance of impacts: vibratory impacts on wildlife do not constitute an "indirect effect." Because such impacts occur at the time and place of the project, they constitute direct effects. **EC6f-06**

6. Page 3, third full paragraph. Note that an elder (by Tierra's definition) asked that aerial photographs be shot to identify and facilitate interpretation of geoglyphs. There is no evidence that this was done. Note also the discussion of the Fish Geoglyph, OCO-003. I did not see this geoglyph referred to in the archaeological survey report (even in the site-list tables), or in the DEIS/R. Tierra quickly assures us that its responsible client "moved previously designed features to avoid the site." We are given no data on what "avoid" means in this case, and (unlike in the case of the Spoke Wheel Geoglyph), there is no claim that the Fish Geoglyph's viewshed was somehow "avoided." Instead, this potential impact is simply ignored. Is this because it was "avoided?" If so, how many other sites have gone unreported for the same reason? **EC6f-07**

7. Page 3, fifth paragraph. Here again we are told how turbine locations have been changed to avoid the viewshed of the Spoke Wheel Geoglyph. Since this supposed half-mile relocation has not been the subject of tribal consultation, it is impossible to know whether it has in any way reduced impacts on the site as understood by tribal members or tribal governments. Someone really ought to ask those who may be impacted before making definitive statements about what has and has not "avoided" impacts. **EC6f-08**

8. Page 4, sixth paragraph. The Arrow Geoglyph does show up in the site list tables in the archaeological report, with the notation that it appears eligible for the National Register under Criteria C and D. As far as I can determine it is otherwise never referred to in the archaeological report or the DEIS/R. This leaves one to wonder how many other sites are buried in the tables but never actually discussed in the pertinent documents. Note too that the anonymous elder also emphasized the importance of surveying to the northeast of the geoglyph, but there is no indication that this was done. **EC6f-09**

9. Page 4, third paragraph. Note the elder's suggestion that ceramic sherd concentrations may represent intentional sacrificial breakage. While there are plenty of ways a pot can get broken, this elder's suggestion needs further consideration, particularly through real consultation with the tribes. A pattern of sacrifices would seem consistent with the notion of the landscape as a spiritually charged one – a "sacred site" in the language of Executive Order 13007. Note too the discussion that follows on this page about the association of ollas with cremations. It may be – for the reasons suggested by the elder in this instance – that there are many cremations in the area that have come over the years to look to archaeologists like mere sherd scatters. **EC6f-10**

10. Page 4, seventh paragraph. This paragraph – though rather clumsily worded – seems to report some very interesting observations by a Kumeyaay elder about incised and etched pottery and its meanings. This begs the question of how incised and etched pottery may have been distributed over the survey area, with what kinds of sites it was associated, how commonly it was found – none of which is addressed in the archaeological report. Tierra seems not to have been interested enough in what its ostensible tribal advisors had to say to follow up on their comments. **EC6f-11**

11. Page 4, eighth paragraph. This paragraph appears to disclose a remarkable gap in the archaeological report and the DEIS/R. Here a site is described – the Cairn Site, OCO-EAM-75 – that contains cairns, a large number of pottery sherds, a probable subsurface component, and – according to the tribal elder visiting it – a spiritual essence that marks it as a "sacred site." Yet EAM-75, as far as I can tell, appears nowhere in the archaeological report or the DEIS/R. It is not even in the site-list tables; EAM-74 is, and **EC6f-12**

EAM-76 is, but not EAM-75. Is this a deliberate effort to hide the existence of a very significant site? If so, how many other such efforts have been attempted, and how many of them have been successful? If it is not a deliberate effort to obfuscate the record, what is it?

EC6f-12, cont.

12. Page 5, first full paragraph. This paragraph indicates (I think) that a road is proposed on or near EAM-75; Kumeyaay consultants express special concern about this, and ask that it not happen. There is no indication in this appendix – or as far as I can discern in the archaeological report or the DEIS/R – that anything has been done about this concern.

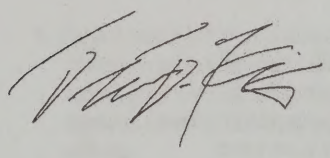
EC6f-13

13. Page 5, third paragraph. Here we have elders asking why tribal perspectives are not better integrated into the archaeological reports, and the archaeologists explaining that archaeology is archaeology and ethnography is ethnography, and that if Kumeyaay want studies, they should ask BLM. I have seldom seen a more elegant statement of the smug archaeological assumption that the laws protect archaeological sites, not tribal cultural places. Presumably Tierra did not see it as part of its scope to carry the elders' recommendations back to BLM.

EC6f-14

Conclusion: This sad little report certainly does not document any tribal consultation, but it does document informal talks with various (presumed) tribal members, some of whom revealed information about the cultural character of the area, and of specific sites, that was apparently then ignored by Pattern and BLM – and that in some cases may have been deliberately buried or obfuscated to avoid the impression that the OWEP would have effects on tribal cultural values.

EC6f-15



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Consulting Archaeologist
December 9, 2011

Kimberly R. Mettler, General Counsel
Viejas Office of Legal Affairs
5000 Willows Road
Alpine, CA 91901

Dear Ms Mettler:

At your request, I have reviewed the archaeological report "Draft Archaeological Survey Report for the Ocotillo Wind Energy Project, Imperial County, CA" submitted to BLM, El Centro Office and prepared by Tierra Environmental Services, San Diego, California, Oct. 2011, and am providing comments.

This report provides the results of an inventory of cultural resources identified within the project area, and the background information about the project, the location, natural and cultural setting, research design, the methods used and the results of findings. It also includes an evaluation of the sites identified to determine their eligibility to the National Register of Historic Places from a scientific perspective.

The report is a draft and the Tribe(s) have an opportunity to provide comments and are encouraged to do so. Because there were portions of the report not available for review, it is problematic in getting a clearer picture of the project, results and recommendations. Six of the nine appendices were not provided to me, including pertinent project maps, medical examiner's report, Native American Consultation and Concerns and copies of site record forms. I note there is no discussion about tribes' concerns or their knowledge of this area. It is unknown to me if this was part of Tierra's scope of work for this project, but clearly Tierra did not address it or refer back to the need for this information in making their interpretations and evaluations. However, without such incorporation, the report is merely an inventory of archaeological resources, and not cultural resources.

EC6g-01

Concerns:

A number of things were noted during the review of concern. Some are comments in the text as discussions and others are editorial mistakes or typos. For example in Table 6.1, several sites were checked as recommended not eligible when in the description part in the preceding section, it was stated that the sites were eligible (see, for example, sites OCO-AMC-028, OCO-AMC-054 and OCO-AMC-091).

EC6g-02

Only one letter from the BLM was sent to tribes (a presumed distribution list is part of

EC6g-03

Appendix C). This letter is dated July 28, 2010. The fieldwork was begun in late September, 2010. It leaves little time for near and far ranging Consultation with the 14 tribes contacted about this project. In an effort to establish communications with Tribes, Tierra provides a telephone log, but never any documentation of written correspondence with Tribes. It appears that the purpose of these calls were to schedule tribal cultural monitors to participate in the field survey as opposed to documenting consultation efforts or substantive information. One letter and nothing more is not meaningful consultation, in my experience. Perhaps there is more from the BLM but it is not included herein and reference to some other location for documentation is not made.

EC6g-03, cont.

More Figures (photographs drawings and site maps) could be added to the report to enrich and illustrate the array of artifacts, features and sites noted during the survey. For example, a photo of a roasting pit and its setting or a drawing of one of the 'geoglyphs' would be appropriate. The two photos that are included (Photographs 5.1 and 5.2) are in black and white and appear to be an attempt to indicate differences in degrees of patination, which is something that cannot be observed using a B&W medium. The 'artifacts' in these photos are not discussed in the text and no explanation is provided as to what kind of artifact they represent. They are the only artifacts illustrated. In the Table of Contents, they are labeled Regional Map and Project Location Map, respectively. Obviously, an editorial error, there.

EC6g-04

In Table 2.2 under Description, better descriptions could be provided other than "Lithic-Isolate," such as flake or point, etc. If these items are waste flakes or formed artifacts their description should be provided to help describe the activities these items represent in the cultural landscape.

EC6g-05

In Chapter 5. Discussion and Interpretations- only one paragraph is used to discuss Agave Procurement Sites (pg. 5-2) despite that approximately 260 roasting pit features were identified within 49 Sites. Several assumptions are made in the report without support including "...camp sites associated with agave were probably occupied during spring and early summer..." and these sites were "...used primarily during Late prehistoric times." First, there is nothing in the report that documents the seasonality of agave harvesting by the Native Americans living in the area. Second, it seems that the seasonal round is not well understood for this area and is certainly not correlated with the general availability of plant resources in the report. The optimal time for gathering and roasting agave in a pit is when the plant begins to bloom . In the subject area, this may occur as early as February but is likely over by March. As a staple food item, it is absurd to think that agave was "...typically eaten *in situ* or transported a short distance." Pg. 5-8. Agave is available only when it matures. Considerable time was spent gathering and processing it to be used throughout the year. It would have been cooked and processed for immediate consumption as well as dried for transportation to winter villages and stored for later use when other food resources were scarce.

EC6g-06

It is frequently reported that the majority of sites relate to the Late Prehistoric period, yet little information is provided to support that contention: because early and late artifacts are found together, the report's assumption is that most of the artifacts relates to the Late Prehistoric period. There appears to be a much longer period of use as demonstrated by the discovery of Archaic Period projectile points (n=8). Also, this is important because it shows a greater time depth that supports a high level of significant to tribal people living today.

EC6g-07

Pg. 6-11. The report states that the agave procurement strategy is neither uncommon nor poorly understood. I don't believe this to be true. This area is likely the southeastern most area within the United States where *Agave desertii* occurs at its lowest elevation. With all of these roasting pits that occur here, what is the fuel source? Has the environment changed since procurement occurred? How old are these features and when did agave become a staple? I am not aware of any recent studies that have provided some understanding of the cultural context and a detailed 'agave procurement strategy' or answers many other related questions. **EC6g-08**

The majority of the archaeological sites identified are determined eligible to the National Register of Historic Places. Is allowing the project to move forward while 'preserving' these sites in this manner acceptable? These types of archaeological sites are an integral part of the cultural landscape. Without the natural landscape the cultural landscape and prehistoric activities would not exist or be completely changed. **EC6g-09**

Additional Concerns:

Pg. 3-13 Trails. This discussion does not go far enough and is misleading. It states that trails "...link places that people traveled to..." and "...trails were used not only for visiting and trade, but also for religious pilgrimages between sacred mountains and other places that figured prominently in their oral traditions." This discussion is centered on long distance trails. Physical evidence of trails only survives where desert pavements are stable. Missing is the discussion about the short segments of "trails" more commonly observed in the study area. In the report, the descriptions of trails only gives their lengths and maybe 'associations' with other artifacts, features and 'sites'. It does not provide for a better context except to suggest that many of the shorter trail segments are parts of larger sites. No further discussion or interpretations are offered in Chapter 5 about these features, whether trails or not. It seems more reasonable to conclude that these short segments relate not to long distance travel through the area but could be associated with other activities taking place within the large context of the camp sites or or areas where they occur or appear to be associated. Since maps and site records were not available at the time of review, I can't refer back to them to better understand the environmental setting of the trails or near and far contexts. Some questions to be asked: How well-established are the desert pavements in which they are situated? Why could these segments not be followed further? Do they run into active washes where there is no preservation or simply just stop? Also, these short 'trail' segments may better fit under the category of ground figures or geoglyphs and relate to ceremonial activities and be associated with other such activities represented in the area. **EC6g-10**

I find it insensitive to use the term *wikiup* (pg. 3-13) instead of the local Kumeyaay terms '*aakyuuch*' for brush shelter or '*'ewaa*' for house or applied to a brush shelter. *Wikiup* is a borrowed term from another tribe from a far away region. **EC6g-11**

In the view of the report authors, the regulations do not support a TCP (traditional cultural property). The authors took a narrow, biased and unfounded view to dismiss the possibility of eligibility as a TCP in support of their client. TCPs are recognized by living peoples and would not be based on archaeological evidence alone. It is not clear just what efforts the agency or the archaeological consultants have made to consult with tribes on this issue. But it appears to have been ignored completely by both. Until the Tribe(s) have an opportunity to provide comments and those comments are included as a part of the analysis, it seems premature to rule out a possible TCP based solely on the consultant's view. I think there is considerable merit to pursuing the subject. Also, it should be considered at a cultural landscape level, too. **EC6g-12**

We are led to believe that the consultants have adequately identified all the 'cultural resources' within the subject area. That may be in question when the survey and site location maps are available for review. It is clear that their interpretations take a narrow and uninformed view and are solely lacking in substance and effort on the behalf of the resources. **EC6g-13**

The site records I received were copies of the original records, not copies of the current recording effort by consultants for this project. The updated site records should contain the total effort in documentation, that is, "thoroughly document all prehistoric and historic resources in the project area..." (Pg. iv.). These records need to be reviewed for adequacy to ensure they provide what they are reported to be providing. **EC6g-14**

Recommendations:

This is a draft report. The tribe(s) should review and provide comment about the report as well as what else they would like to see done (additional studies or other data collection; their own ethnographic overview and research in support of their goals). All of these things would be reasonable and appropriate. For example, a good list of plants of economic importance to tribes with a discussion of when and how they were used would provide helpful insights into seasonality and settlement patterns. Additional studies of any of the resources would only enhance their cultural value and the cultural context of the whole. **EC6g-15**

The BLM needs to analyze whether this is a cultural landscape. A review should look at the larger context of settlement and subsistence patterns between the coast, mountains, desert floor and Colorado River. It must include tribal values. By carving up the area for this project and allowing for this kind of development would be the same as placing a dirt parking lot on the Capitol Mall. Very unsightly and incompatible. **EC6g-16**

Russell et al. (2004) is referenced in the report yet its relevance is not provided. This should prompt further discussion and review in support for a cultural landscape. **EC6g-17**

It appears from the documentation available that consultation has not concluded and should proceed between tribes and the highest levels of federal government. **EC6g-18**

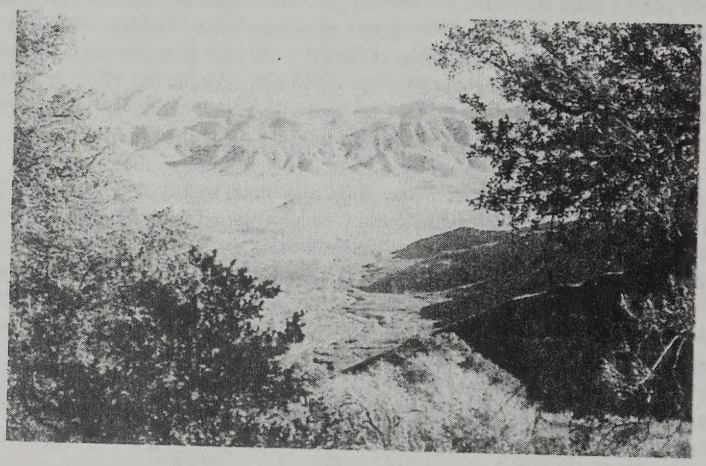
Please feel free to contact me if you have any questions or if I can be of further assistance.

Daniel F McCarthy

Daniel F McCarthy -- short Bio

I received my BS and MS in anthropology from the University of California, Riverside. For the past 40 years, I have worked at Anza-Borrego Desert State Park, Joshua Tree National Park and throughout Southern California compiling photographic inventories of rock art sites in these areas and throughout the western region. I have worked with Elders and Traditional Practitioners for over 35 years throughout southern California. For the last 17 years he has been the Tribal Relations Program Manager for the San Bernardino National Forest. Earlier this year I received the National Lifetime Achievement Award from the Office of Tribal Relations.

Research interests include desert archaeology, aboriginal trail systems of the Sonoran, Mojave, and Colorado deserts; rock art distribution, documentation, interpretation and working with tribal communities in public education of Native culture; and recording string figures. I conduct southern California Native American cultural awareness classes providing information about native plant uses (particularly agave, acorns, yucca, prickly pear and pinyon), rock art, and material culture. The annual Malki Museum Agave Harvest and Tasting is in its 17th year which has been organized and lead by me. I have been co-instructor in offering an Applied Archaeology field school, just having completed its 6th year. I have worked with several tribal governments (particularly Serrano, Cahuilla, and Luiseño), traditional practitioners and Native organizations such as the Southern California Indian Basketweavers Organization, where he is currently vice president.



WIIPUK UUN'YAW = DESERT TRAILS
A LIFE STYLE OF THE OLD ONES

INTRODUCTION

The photograph on the front page of this document is a view into the desert from the edge of the Laguna Mountains. The painting below the desert view shed represents the Old Ones entering the Cotton Wood Trail (WIIUK UUN'YAW) from the Lucas Ranch (the Former Laguna Indian Reservation). The Old Ones used many of the old prehistory trails to move between the mountains and the desert floor. This was the life style of the Old Ones who lived in this region; once they entered the desert they would chose any one of the many other foot trails that lead across the desert floor into other areas such as San Felipe, Warner Springs, A-ka-ha, Salton Sea, Obsidian Butte, Agua Caliente, Mountain Springs, all the way to the Colorado River and any number of other distant places to include the Ocotillo Wind Energy Project area.

The following pages give another view of what such a journey is like today and what is in jeopardy by today's lifestyle from the cumulative effects that the Green Energy Projects will have across Southern California's Desert Landscape.

The painting of the Old Ones entering WIIUK UUN'YAW was created by the late SuSaan Lucas Garcia, about 1968-70. My father, the late Tom Lucas, had talked about the old ways and the movement of our peoples back and forth between the mountains and the desert - a life style that was still in use when he was a boy at the turn of the century. After listening to those accounts, SuSaan went home and created that painting from the image that her mind's eye formed as she heard our father tell of the old ways.

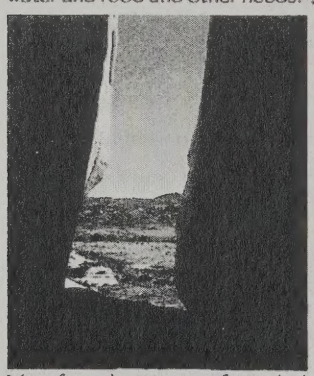
All photographs in the document were taken by Carmen Lucas, with the exception of Donal Hord, which was scanned from a San Diego Historical Society article, the one of Yellow Sky was scanned from an article; other old photographs belonged to my father and mother.

With endurance, intuitive knowledge, understanding chemistry and physics; knowledge of plants and their use as food, and/or medicine, the old ones moved across the entire Southern California Landscape with the rhythms of the environments; using what was needed without destroying the environments. Our Old Ones wrote our history in the soils of the earth across the coast, inland, mountains and deserts of Southern California.

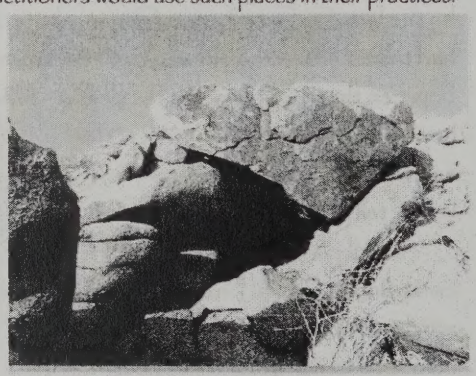
It has been my good fortune and extraordinary privilege to walk in many of the Old Ones' footsteps from coast to coast along many of those trails that were the life style of a time that was much like the freeway system is for modern society today. As a young child, my father would walk us along the old trails of our ancestral landscape. The trails would lead from one prehistory "camp" to another.1*

As I walked with my father he would point out the history that the Old Ones recorded as they left a mark on a tree, a tool along the trail and manos in milling out crops. He would point to the many mountains in the distance. One such mountain is Granite at the foot of the Mountain Landscape and the threshold to the desert floor and San Felipe. He told me that the last time that the Kwaaymii Bird was heard singing was at San Felipe, just before the influx of the Chicken Pox and Fevers hit that area and killed them all. Old Lady Gertrude, Juan Baptist's wife was from there, she had left to live with Juan in Laguna just before those germs hit that area.

My father would take us to rock shelters where he knew we would be safe to hide out in case strangers came, he thought us to be on the lookout for uninvited people coming onto the reservation, to never show ourselves until we knew who was there and we were comfortable at their coming. Some of those rock shelters were used by the Old Ones as a place to be out of the elements, to stash ollas with water and food and other needs. Some Medicine practitioners would use such places in their practices.



View from the interior of a rock shelter. This shelter is in McCain Valley, view is to the east and Mountain edge to the Desert.

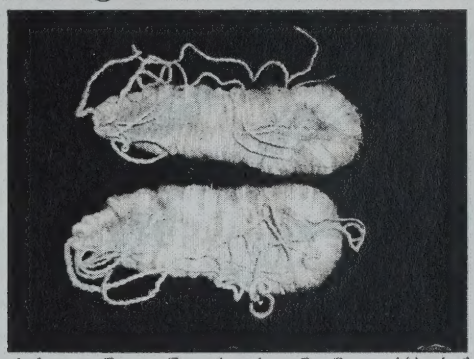


Small shelter in Ocotillo Project area.

*1 Even though archaeologists have been advised numerous times to view and record the whole of the Landscape under study; their systematic process is designed to confuse and minimize the importance to the record; Cultural Resource Management Archeologists refer to such areas as "sites"; example Lithic Scatter, Rock Feature Site; Ceramic Scatter Site, Agave Procurement. Such terms do not conjure images in one's mind as to what the prehistory record states.

When we came to an old camp area my father would tell me about the things that were still there just as the Old Ones left it. A stone tool may have been used to cut a Mescal *2 stalk, and how they would peel the skin off the stalk with the use of a scraper like stone tool. Many of the stone tools were made right where the Mescal was growing and when they were finished with it they left the tool where they used it.

The Old Ones would gather the plant in the early spring when the stalk was about two to three feet high, if the plant was taller it was tuff and tasteless. My father also showed us how the leaves were allowed to dry out then pounded and twisted to use as string and from that they would make nets in which to carry Ollas. The picture on the cover page of this document illustrates how those nets were used and made. Sandals were also made from the leaves of Mescal.



These sandals were made by my Great Grandmother SuSaana Klitch, for my father when he was a little boy, they are made out of Yucca twine, Yucca grows on the mountain edges, the stalk was used as food the same as Mescel/Agave and the leaves were also processed for twine to be used as nets, shoes etcetera. The old ones wore this type of sandal on the desert floor to keep the hot desert sand from burning their feet.

Three stone tools that were made and used by the Old Ones; left on/in the earth where used to become history written in the earth for those of us who are the lineal decedents and those Indians who are yet to be born.

*2 Archaeologists refer to Mescal as Agave. I never heard one of the Old Ones that my father knew call this plant anything other than Muskel

The Old Ones who occupied the mountains used the desert trails on regular basis, those who occupied the desert area would use the mountain trails on a regular basis. The trails across the desert floor from the mountains to the Colorado River or to the west and the Pacific Ocean are still known and visible and continue to be used by some of the descendants of those Old Ones who created those trails. The photograph on the front page of this document is the view from one of the trails leading to the desert from the mountains. One of the many trails was what is known as the Yuma Trail it has been recorded as running from Mexico to Yuma, to Laguna, and down over East Mesa, past Descanso on down to the cove on San Diego Bay and old La Playa. (Old Highway 80 follows along part of the pre history trail).

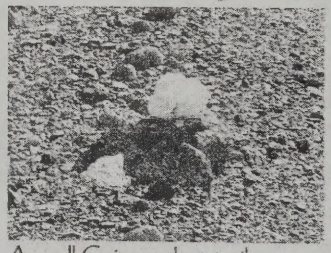
One of a number of ancient trails from mountains to the desert. Photo taken after 2001 Pines Fire.

Another ancient trail in the foot hills between mountains and the desert floor.

Desert floor shows free way system of ancient trails. Coyote Mountain is in the background.

Along the trails it is not uncommon to find Cairns that have been created by the Old Ones to mark the trails; there were times when one of the Old Ones and often infants or children died along the movement from coast to coast; often Cairns were created to mark those graves or events.

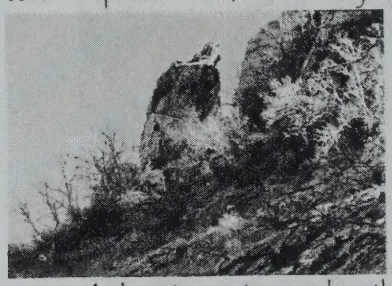
One of many Cairns that mark one of the ancient trails down the mountain edge to the desert floor.

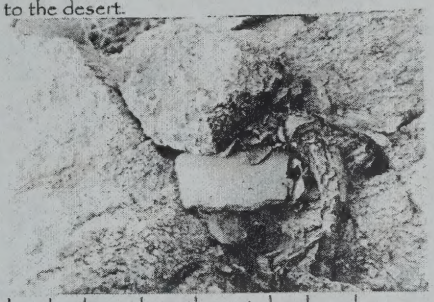


A small Cairn marks a trail across desert trail; the subtle construction with a Quartz or Limestone is used so that the moon light will reflect on it so that it can be seen from a good distance.

A Cairn that is a Shrine of some sort; could be a burial; regardless of what it may have been created for, it has and retains its spiritual value. This Cairn is in the project area.

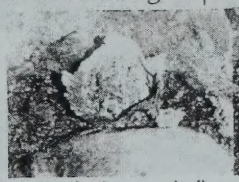
As I walk down the old trail to the desert, I pay homage to the old Guardian of the Trail; the old woman with a shawl wrapped around her shoulders sits on the mountain edge and watches as we travel up and down the trail, I stop and leave an offering of fern leaves and a stick on a flat bolder like the Old Ones did as they stopped to say thank you for a safe journey and ask for continued protection as I continue the journey to the desert.

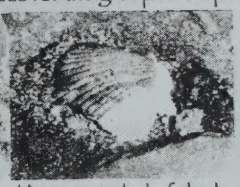




As I continue my journey down the trail to the desert I see the pot shards and am reminded of how the Old Ones carried their ollas full of mesquite beans, acorns, jerky and other needed items up and down the trail. There were places where they would stop and build fires and spend the night. I am reminded of the story that my father told me as how things were done in the old ways. There was always a runner who would gather up the hot coals and place them in the fire carrier, and run ahead of the rest until the coals started to cool, the runner would stop build a new fire and that would be ready by the time the rest caught up.

Fire Carrier made by SuSaana Kiletch, my Great Grandmother, 115-120 years old, died 1914. This fire carrier was designed to have two openings so that the air would help to keep the coals alive as the runner ran ahead to find a good place for the group to stop for the night.

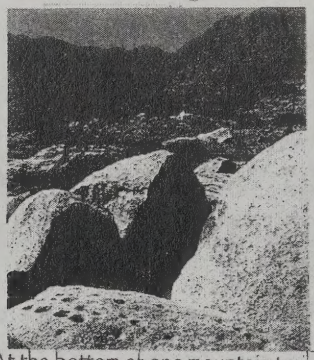




Along the trail I also find a sea shell and I am reminded of the how the Old Ones traversed the country using the old trails from Coast to Coast (Pacific Ocean to the Colorado and from the Colorado to the Pacific Ocean).

Half way down the trail, I come across the Shrine, and as always I a m awed at this magnificent place where I remember hearing the words of my father telling me of when the young boys of fourteen where instructed by the Medicine man to select a small flat rock and how to toss it underhand into the air to land on the shelf of the shrine. Depending on where the rock landed, the Medicine man would be able to tell them how long they may live. This magnificent place is also a place to give a prayer to thank the great one again for a good a safe journey and to ask for continued protection and provisions throughout our travails.

I remember looking at the ground below the shelf, and almost overwhelmed at the number of small rocks at the base of the shrine and could not help but wonder how may Indians my ancestors, have pass through this place and left a rock with a prayer and how many years before has this been a thoroughfare in that movement with the rhythms of the environments.



At the bottom of one mountain trail, a table of cupules, and a living area. These are places of ceremony.

Another place where ceremony took place. A black cross is under the chin rock figure and another table of cupules.

This photograph documents the remnants of one of the Old One's shelter that was still standing at our old ceremonial area in the desert below the mountains. I often took my father there to visit and reminisce. He told me that when he was very young (3-4 years old) the Old Ones took him to the last big ceremony that was held at this place called A-Ka-Ha. Indians from all over had come to the ceremony; the event scared my father so badly that he ran away; his Grand Mother SuSaana sent the Yuma runners after him. As my father began to age, I would take him to many of the places such as this and burial grounds, the last few years it was the bigger part of his daily actives; first thing in the morning he would feed and sing a chant for all the squirrels and birds that lived around his cabin. After ward he would have me drive him to a number of the Old places where he and his elders frequented; as he got closer to his life journeys end it was the Old Burials in the mountains and the deserts that he especially made an effort to visit; and just as he did when he was Eighty years old, on his last trip down our old Trail to the desert he would run ahead of us to special places like the Guardian of the Trail and offer a prayer, giving thanks for that part of his life it may have shared, and told what ever it was that his time was coming to a close so he was their to offer a prayer of thanksgiving and ask for protection of that place into the future.

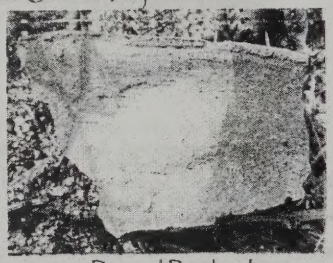
It has been well known that many of the Old Indians did not want their pictures taken. The above photograph was taken in 1933; the skeleton of the shelter is made of Juniper branches. In the foreground are old horns of Big Horn Sheep, Metate and Mano. The reader of this document is asked to study the photograph closely to learn what else was documented by the camera's shutter.

All along the trails there are broken stones from the making of stone tools as they were needed and many pieces of broken pottery (Pot Shards). Some of them are a result of the pot being broken in use, some times if the pot was stashed in a rock shelter an Earth Quake could have dislodged it and caused it to break. Sometimes the potshards are brought up from the interior of the earth by rodents. I understand such places to be old living areas and places where some of the Old Ones have their final resting places. Then again there are places where a number of pots were sacrificed as part of the burial and or the year after ceremony. A variety of clay sources are used to make pottery. Some of the clays are found on the coast, some in the mountains, some in the foot hills between the desert and the mountains and some comes from the desert floors. The best quality comes from the arroyos deep in the desert.

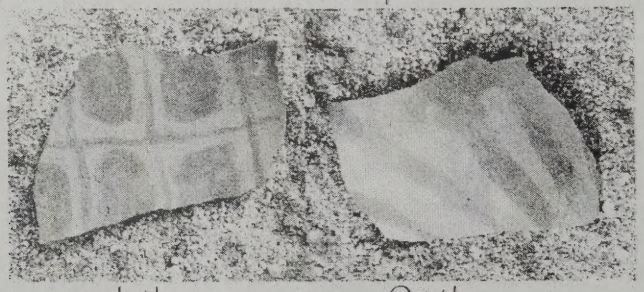
Many things are created from clay. They are: pipes, small containers for babies' food and larger pots to store water, store food stuff, cooking utensils, rattles, effigies and such. When I traveled my ancestor's trail I saw a lot of pot shards most are plain and some were decorated either by painting and incising and or etching. These shards below are in the Ocotillo Project area.

Plain rim pot shard.

Incised handle for pot.



Painted Potshard.

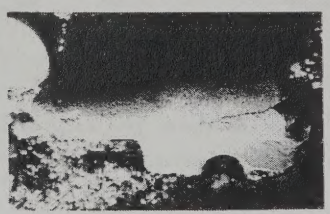


Inside

May be a Tortoise Motif.

Outside

A symbolic image of freedom.



Clay Pipe fragment

Stucco Potshard

Mid way down the Old Trail to the desert, one gets a view of Granite Mountain. This mountain has always appeared to be naked; it has commanded my attention all of my life. About 1988, I had an opportunity to hike the mountain. As we worked our way up the east edge, we found where a deer had been killed by a Mountain Lion. The deer was on its back and stashed partly under the bush, the stomach and the contents had been taken, and leaves were scattered over the opening. As we continued our hike up the mountain we came across an old village site.

When I returned home I told my father about my adventure. He told me that the mountain is Sacred, and that during the time when the Old Ones were running away from the Missions some of them went to Granite Mountain. Way up on top there was an old rock that looked like a potato and under the rock was a spring so the Old Ones were successful in hiding out on this Mountain without detection.

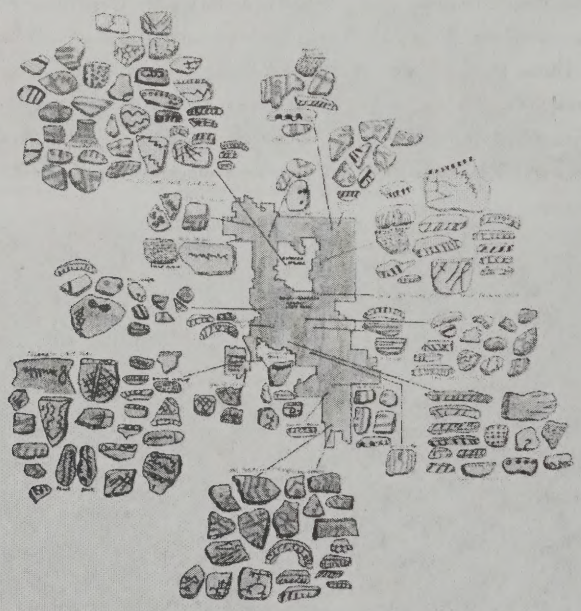
When I cross the desert floor of Southern California in the early morning hours I am often blessed by being a witness to the magic of the desert environments. A sunrise such as this in Ocotillo will no longer be possible with the 12,436 acres of 450 feet tall Turbines across the desert floor.

EC6h-01

A number of years ago I was asked by the Anza Borrego State Park Archaeologist to review the Pot shards (Ceramic) collection that is housed in Anza Borrego State Park Curation Facilities. As I worked my way through the collection, I began to realize that a small number of the entire Pot shard collection had abstract designs on them that may have been etched in the side of pots during the creation of the pot; others had been painted with red abstract designs. Still some others had been incised around the rim of some pots. I asked the Archaeologist if anyone had ever really looked at those shards. Her answer was no. As time went on the Archaeologist acquired some funding and contracted me to study the Pot shards in the Anza Borrego State Park Collection. The following image is what I created for Anza Borrego State Park during my contract period.

The ocher color in the center of the page represents the foot print of Anza Borrego State Parks. The surrounding images reflect the actual images in the Anza Borrego State Parks Pot shard collection that had decoration of one form or another.

When I was a child, I had found a pot shard that had been incised; when I showed it to my father he explained that the Old Ones had done that so that they could find that pot in the dark of night.

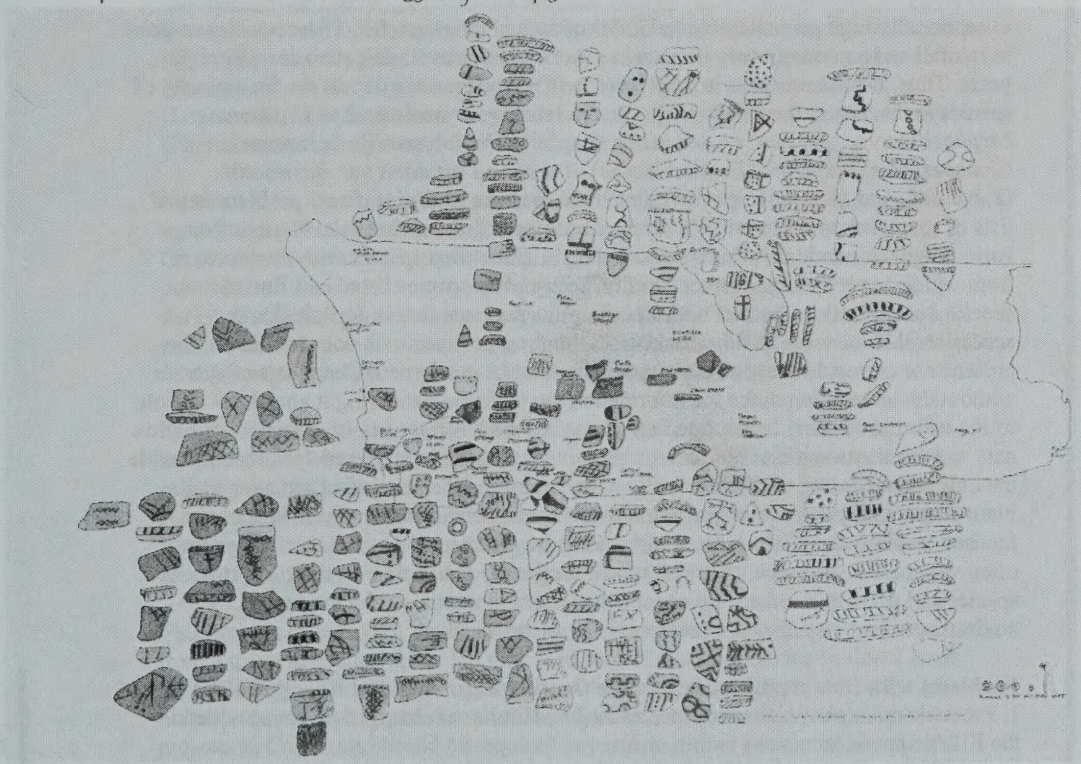


I realized that this wonderful prehistory art is missing and/or has been ignored in the

Archaeological record. As my time and finances permitted I traveled to the San Diego Museum of Man, where I was given access to the Malcolm Rogers (the Guru to San Diego Archaeology) pot shard collection to study. I photographed the collection focused on the decorated shards which I used the photographed images and created the map below. I placed the image of the pot shard in the approximate area of where the decorated pot shards were located by Rogers) Archaeological activities through out San Diego and Imperial County. The spread across the two counties is interesting and I presented the results of this study to the Society of California Archaeology in the hopes that it would spark an interest and a closer look and documentation to the records. From time to time I have received photographs of painted and or etched shards from interested archaeologists.

This information is relevant to the Ocotillo Wind Project because ceramic deposits can and often do contain much more information than what has been recorded by the Archaeologist who simply identifies such deposits as "ceramic scatter". As can be seen and through this discussion of Pot Shard (Ceramics) there is more to understand than what the Archeological report for the Ocotillo Wind Energy Project simply calls "ceramic scatter".

EC6h-02



PAINTED AND ETCHED POT SHARD ACROSS SAN DIEGO AND IMPERIAL COUNTYIES

Comments on the Botany of the Ocotillo Express Wind Energy EIR/S

By Jon P. Rebman, Curator of Botany, San Diego Natural History Museum

15 November 2011

Introduction: Climate, biogeography, and geology combine to make Southern California home to one of the highest biological diversity areas in the USA. However, as a result of development pressures on this biodiversity this region also contains some of the highest overall densities of endangered species in our country. Currently, 73,353 acres of public BLM lands in Imperial County are being considered for energy development projects which are a concern because the flora of this region is not well documented. There are fewer than 12,400 historic specimens from Imperial County known in the California Consortium of Herbaria (CCH), compared to 138,800 specimens in the CCH for San Diego County, which is approximately the same geographic size. This dearth of information on the botanical resources of Imperial County leaves conservationists, agencies and land managers with a limited amount of scientific data along with mounting responsibilities for conservation and informed decision-making. To add to this problem, this region is extremely dry in most years and the flora of the Lower Colorado River subsection of the Sonoran Desert (which includes almost of Imperial County) has an exceptionally high percentage (over 50 %) of annual plant species. These species respond to rainfall and some may only be seen in years with ample rainfall such as in El Niño years. Thus, floristic surveys in most years will not adequately document the majority of species in this desert flora including rare and sensitive annuals such as *Chaenactis carphoclinia* var. *peirsonii* (Asteraceae), *Cryptantha holoptera* (Boraginaceae), *Chamaesyce platysperma* (Euphorbiaceae), *Astragalus insularis* var. *harwoodii* (Fabaceae), and *Ipomopsis effusa* (Polemoniaceae). Another significant problem is that lists of species currently available for the impacted regions of Imperial County from various agencies and individuals may contain misidentified species with no vouchers from which to verify their correct identity. Every plant species listed in a floristic checklist must be documented with a herbarium specimen that is deposited and accessioned in an accredited herbarium. Without proper specimen documentation, the presence or correct identity of these species cannot be confirmed. Checklists of species without documentation make the information unverifiable, rendering it anecdotal and out of the realm of science. Inaccurate lists of species may also lead to imprecise distribution data and to mismanagement of biological resources. Actual vouchered specimens provide the only scientific and verifiable means of documenting the flora of a particular region. Plant surveys may be required prior to development of land; however, most laws are focused on federal- and state-listed rare and endangered species, so these surveys are often very narrow in scope. Surveyors most frequently focus only on their target list of species and often miss other rare or sensitive plants, potential problems caused by noxious species, or species not previously known to the area.

Problems with Botanical Findings of the Ocotillo Express Wind Energy EIR/S

1. Probable misidentifications of species in the plant list of observed plants provided in the EIR/S appendix:

EC6i-01

Various species found in the list of plants observed during the field surveys appear to be misidentifications as plant species that are not known to occur in this

part of California and have not yet been documented to occur in Imperial County based upon current CCH records. These include: *Cryptantha recurvata* (Boraginaceae), *Raphanus raphanistrum* (Brassicaceae), *Orobanche parishii* ssp. *parishii* (Orobanchaceae), *Parietaria pensylvanica* (Urticaceae), and *Pentragramma triangularis* ssp. *maxonii* (Pteridaceae).

The observed record of *Wislizenia refracta* ssp. *refracta* (Capparaceae) is also a probable misidentification because this subspecies occurs only farther north in California. What was observed by the surveyors is most likely the sensitive taxon *Wislizenia refracta* ssp. *palmeri.*

EC6i-01, cont.

2. In November 2011, I conducted a point-radius geographic search for any historic specimen records in the CCH database that occur in the immediate vicinity of the proposed boundaries of this project area. This spatial search resulted in various plant species that are listed in the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants of California, but were not adequately addressed in the botany sections of this EIR/S or observed in field surveys.

CNPS-listed sensitive species that were previously documented in the local area, but were not addressed very well in the report include: *Matelea parvifolia* (Apocynaceae), *Cryptantha costata* (Boraginaceae), *Cryptantha holoptera* (Boraginaceae), *Bursera microphylla* (Burseraceae), *Eucnide rupestris* (Loasaceae), *Horsfordia newberryi* (Malvaceae), *Mimulus aurantiacus* var. *aridus* (Phrymaceae), and *Lycium parishii* (Solanaceae).

Three of these sensitive plant species in the list above are annuals that only show up in years with ample rainfall. These are: *Cryptantha costata* (Boraginaceae), *Cryptantha holoptera* (Boraginaceae), and *Eucnide rupestris* (Loasaceae). It is possible that these species were overlooked or that they were not even present during the 2010 field season due to inadequate rainfall. Two other species are easily overlooked and/or commonly misidentified in the field. These include: *Matelea parvifolia* (Apocynaceae) and *Lycium parishii* (Solanaceae).

EC6i-02

The woody perennial species of *Bursera microphylla* (Burseraceae), *Horsfordia newberryi* (Malvaceae), and *Mimulus aurantiacus* var. *aridus* (Phrymaceae) would probably have been obvious to surveyors if present in the project site. However, I do believe that it is still important that the report indicates that these three sensitive species have been documented with voucher specimens in the nearby vicinity and do almost occur within the project area.

This process of checking the CCH for voucher specimens historically collected from a given area such as for the proposed project site highlights a protocol issue for this EIR/S. With the growing resource of databased and georeferenced herbarium specimens present in the CCH database, all planned development projects in California should be required to perform online geospatial searches to look for historical occurrences of sensitive plant species. This process is

extremely important for studies in areas like Imperial County where so many annual species do not show up every year.

EC6i-02, cont.

3. It should be noted that the field surveyors' discovery of the sensitive plant species, *Linanthus maculatus* (Polemoniaceae), is a very large disjunction (greater than 70 miles) from the previously known distribution of this species in the Palm Springs area and to the north in San Bernardino County. This rare plant discovery from the Imperial County region provides significant evidence that there may be many more botanical surprises that might be expected to occur in the proposed project area, especially in a year with more rainfall.

EC6i-03

4. Two sensitive plant species (*Cylindropuntia wolfii* (Cactaceae) and *Acmispon* [*Lotus*] *haydonii* (Fabaceae)) found and addressed in the project area and report deserve special attention. Both of these species have very limited distributions and impacts to their populations as part of this project could increase their sensitivity ranking significantly. An analysis should be conducted in order to obtain exact values, but I would estimate that it is possible that this project might impact as much as 25% of the entire species populations for *Cylindropuntia wolfii*. This cactus species is gynodioecious (individuals are either female or bisexual) and its fruits do not produce many seeds either so it is not known exactly how an impact of this degree might affect this species' long-term viability. The field surveyors estimated approximately 25,000 individuals of this cactus species within the boundaries of the total project site and although not all of these plants will be impacted these populations may represent the most dense populations for this species. The only other area that I am aware of where there is a high density of individuals of *C. wolfii* is in the vicinity of the Mountain Springs exit off of Interstate 8.

EC6i-04

Recommendations

1. In order to be more scientifically accurate, especially in a region like Imperial County where there is very limited data on plant species presence, richness, and distribution, I would recommend that voucher specimens for herbarium deposition be collected for each plant taxon in the project study as part of the biological inventory process. This endeavor would help to remedy possible misidentifications of observed species such as those indicated above that are not known to occur in this part of California.
2. In a region like Imperial County where there is a high number of annual plants that only respond in certain years with ample rainfall, it should become common practice to conduct a geospatial search of historic herbarium specimen records (i.e., CCH database) when doing a biological inventory of a given area. In this manner, botanical consultants would at least be aware of various sensitive plant species that may not be present during the survey period but do occur in the area in some years with increased rainfall.
3. Although it is probably not possible due to time constraints, I would recommend doing biological surveys only in years when there is ample rainfall in particular desert habitats so that a better representation of the entire flora can be obtained, understood, and more concisely evaluated in the EIR/S.

EC6i-05

4. An improved analysis of the direct impacts on populations of sensitive plant species with very limited distributional ranges that are known to occur in the project site and will be impacted significantly creating a possible increase in the listing level of sensitivity for that species should be done. For example, *Cylindropuntia wolfii* (Cactaceae) was reported to have approximately 25,000 individuals in the project study area and these populations may represent a significant percentage (up to 25%) of all the known individuals for this species as a whole. Thus, if the populations on the project area are impacted then there should be a subsequent regulatory increase in the rarity status of this species. More detailed information on species such as this should be required in order to quantify the impacts of this development project.

EC6i-05, cont.

RIVERCROSSING STRATEGIES

2 December 2011

Kimberly R. Mettler, General Counsel
Viejas Office of Legal Affairs
Viejas Band of Kumeyaay Indians

Subject: Ocotillo Wind Energy Facility Draft EIS/EIR

Background and Understanding: The Bureau of Land Management and the County of Imperial, California, has prepared a Draft Environmental Impact Statement/Environmental Impact Report to decide whether or not to allow the construction, operation, maintenance and decommissioning of a 12,436 acre wind energy project.

I was retained to objectively review the Draft EIS/EIR Purpose and Need section and the Proposed Action and Alternatives section, and to provide a professional opinion as to whether the document meets reasonable standards and complies with the National Environmental Policy Act and the Council on Environmental Quality Regulations (40CFR1500-1508).

My review is an objective review based on my knowledge of NEPA and CEQ regulations. I was the Associate Director at the Council on Environmental Quality from 1993 until 1999. I have taught NEPA implementation at Duke University for the last 20 years and have been involved in preparation and review of NEPA analyses; I have been the decision maker on projects based on NEPA review, and I have been in positions that required me to prepare NEPA regulations, approve NEPA regulations, and mediate disputes among federal agencies over the interpretation of the requirements of NEPA.

Purpose and Need: The purpose and need drives the reasonable range of alternatives. If the purpose and need is drawn too narrow, it will limit a reasonable range of alternatives. It provides the framework in which "all reasonable alternatives" will be identified. The lead agency -- the federal agency proposing to take an action -- has the authority for and responsibility to define the "purpose and need" for purposes of NEPA analysis. This is consistent with the lead agency's responsibilities throughout the NEPA process for the "scope, objectivity, and content of the entire statement or of any other responsibility" under NEPA. 42 U.S.C. §4332(D); see also, 40 C.F.R. §§1501.5, 1506.5.

Section 1502.13 of the CEQ Regulations states, "[t]he statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." Generally, CEQ anticipates that this is a one-two paragraph statement that demonstrates the problem that requires action and provides general context and understanding and reason the agency needs or wants to act. Often agencies are responding to a problem that requires action because of a law, regulation, or mission change.

The key word, for the purposes of this discussion is "underlying". The underlying purpose of the Wind Energy Facility is "energy production" as the Corps of Engineers states on page 1-4. A later paragraph further states that the "overall purpose is to provide a wind energy facility ranging in size from 315 MW to 465 MW in Imperial County, California."

One of the questions that a purpose and need statement should answer is: "Why are we considering this proposed action?" It should then discuss the relationship between the desired condition and the existing condition.

It is clear that the "underlying purpose and need" should be to ensure energy is available to the citizens in this region. That kind of purpose and need would open up alternatives such as solar, coal, nuclear and perhaps other sources. A similar EIS to develop wind resources in Nantucket, Massachusetts evaluated both renewable and nonrenewable alternative technologies, as well as 17 alternative wind park locations of widely varying scale, both on land and offshore, and both within and outside of Nantucket Sound. Even then, however, the lead agency, Minerals Management Service, stated, "[t]he underlying purpose and need to which MMS is responding is to develop and operate an alternative energy facility that utilizes the unique wind resources in waters offshore of New England employing a technology that is currently available, technically feasible, and economically viable." Part of that justification, or need, was the requirement of the New England Power Pool to achieve the renewable energy requirements under the Massachusetts and regional renewable portfolio standards.

In this case, the BLM is responding to the Obama Administration push to develop more renewable energy on federal lands. Secretarial Order 3285 (March 11, 2009) signed by Secretary Salazar directs the department to approve non-hydropower renewable energy projects on the public lands with a generation capacity of at least 10,000 megawatts of electricity by 2015.

Courts give agencies great deference in defining the purpose and need. In Stein v. Barton, the court said, "NEPA does not require a Federal Agency to consider alternatives which do not achieve the purpose contemplated for the proposed action, and NEPA does not circumscribe an agency's discretion in designating the project's purpose."

While the Courts give agencies deference, they have also cautioned that a purpose and need statement must not be so narrow as to define "reasonable alternatives" out of existence. They also have recognized that federal agencies should respect the role of local and state authorities and appropriately reflect the results of that process in the

federal agency's NEPA analysis of purpose and need. North Buckhead Civic Assoc. v. Skinner, 903 F.2d 1533 (11th Cir. 1990). Courts have cautioned agencies not to put forward a purpose and need statement that is so narrow as to "define competing 'reasonable alternatives' out of consideration (and even out of existence)", Simmons v. U.S Army Corps of Engineers, 120 F.3rd 664 (7th Cir. 1997); (see also, Alaska Wilderness Recreation and Tourism Association v. Morrison, 67 F.3d 723 (9th Cir. 1995).

The lead agency has authority to define the purpose and need in consultation with cooperating agencies. Deference to the lead agency reflects CEQ's expectation and experience in other settings where an agency has the primary substantive expertise and program responsibility. If a cooperating or joint lead agency identifies substantive or procedural problems with the purpose and need statement, including an omission of factors, important to that agency's independent legal responsibilities, the agency should raise those issues immediately and, if necessary, elevate those issues to higher-level decision makers in the region and at headquarters for resolution.

It is my conclusion that a more robust discussion of purpose and need would provide a more open discussion about energy that may lead to more, perhaps better, alternatives with fewer environmental impacts, for our energy future. California's stated purpose and need is that they are trying to meet an RPS goal, DOE's stated purpose and need seems to be to provide loan guarantees, and the BLM stated purpose and need is to respond to a request for a ROW to build wind turbines. If indeed California and DOE have a clear purpose and need and this is to be taken at face value, this opens up alternative sites for this project that are not addressed in the alternatives in the Draft EIS/R. The lead federal agency, BLM's, purpose and need is so narrow that only this site was considered and they have unreasonably narrowed the alternatives.

Alternatives: While Alternatives 1, 2 and 3 are ostensibly "alternatives" they share a massive amount of infrastructure that does not significantly change no matter how many turbines are used. Depending on which alternative is selected, the total footprint may shrink, but there are so many shared project components that would have substantial impacts (i.e., foundations, operational and maintenance facilities, transmission lines, fiber optics, switchyard, roads, concrete plant, etc.) that they are not true alternatives under NEPA. It is my opinion that there should be some form of sub-alternatives, which consider different ways to handle different infrastructure items.

EC6j-02

Impacts: It is very troubling that the discussion of the California Desert Conservation Area Plan (an important asset to be sure) has so much more detail and thought than the cultural resources discussion. The project calls for up to 155 foundations, excavations of 10 foot deep holes for each foundation, construction of 42 miles of roads, and installation of 83 miles of fiber optic cables underground. It is my opinion that the potential impacts here call for a more detailed look at alternatives to avoid and mitigate, or address other locations with fewer impacts. The impacts at this site are such that a much firmer commitment to mitigation and more robust analysis of the irretrievable commitment of resources that this project entails is warranted.

EC6j-03

The table on Page 2-27 shows impacts on "known cultural resources" with no firm commitment as to discovery and mitigation. EC6j-04

The same table states categorically there are no environmental justice issues and that is questionable given the nature of the cultural resources important to tribes. This is worth further exploration. EC6j-05

Tribal Consultation: On Page 1-10 where BLM discusses the Plan Amendment Process, there is a discussion of opportunities for public comment, including input from "federal, state, and local government agencies". They discuss their coordination with the State Historic Preservation Officer. In contrast, there is scant mention of government-to-government consultation, nor any discussion about seeking input from tribes in the sections I reviewed. For example, Section 1.5 "Relationship of Proposed Action to non BLM Policies, Plans and Programs" discusses Executive Orders, environmental laws, and state laws but still no mention of their Trust Responsibilities. While the public can have an opportunity to comment, the Indian Trust doctrine is a higher standard and requires consultation on a government-to-government basis. EC6j-06

Table 1-1 mentions the Native American Heritage Commission entitlements required for the project, but it is difficult to discern that this was done in consultation with tribes, although they say they have invited tribes to consult (Section 1.6), Page 1-14. EC6j-07

On December 1, 2011, the Secretary of Interior announced a Tribal Consultation Policy for the Department of the Interior, which launches "a new era of enhanced communication with American Indian and Alaska Native tribes. The new policy emphasizes trust, respect and shared responsibility in providing tribal governments an expanded role in informing federal policy that impacts Indian Country."

"This comprehensive initiative reflects President Obama's commitment to strengthening the government-to-government relationship between the United States and tribal nations and recognizing their fundamental right to self-governance," Secretary Salazar said in signing a Secretarial Order implementing the departmental policy. "The new framework institutionalizes meaningful consultation so that tribal leaders are at the table and engaged when it comes to the matters that affect them."

"Under this policy, consultation will be an open, transparent and deliberative process," said Assistant Secretary Echo Hawk. "Forging a strong role for American Indian and Alaska Native tribes at all stages in the government's decision-making process will benefit Indian Country and federal policy for generations to come."

This new policy alone would seem to require a supplement to this DEIS. CEQ Regulations (40 CR 1500-1508) state that agencies:

1. Shall prepare supplements to either draft or final environmental impact statements if:

(i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or

(ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

2. May also prepare supplements when the agency determines that the purposes of the Act will be furthered by doing so. (1502.9)

A case can clearly be made that there are new circumstances arising out of the Administration's new policy and there is a direct bearing on the project from more robust consultation with the tribes most affected. There is no question, either, that the purposes of NEPA would be furthered by these consultations that have an irretrievable commitment of resources. **EC6j-08**

Such consultation clearly did not happen within this impact analysis. The NEPA process is routinely applied and familiar to virtually all federal agencies, making it particularly useful to:

- Identify specific problems or issues of concern to tribes
- Bring tribal officials or staff to the table
- Develop additional alternatives
- Secure agency compliance with trust responsibility
- Familiarize land managers with issues specific to locale or the facility
- Ensure compliance with E.O. No. 13084 - Consultation & Coordination with Indian Tribal Governments **EC6j-09**
- Ensure compliance with E.O. 13007 - Indian Sacred Sites
- Meet the Agencies' Responsibilities for Protecting/Accommodating Access to Indian Sacred Sites, Interior Dept., (512 DM 3)
- Ensure compliance with the National Historic Preservation Act, 16 U.S.C. 470 § 106
- Provide the agency the information needed to avoid conflict, litigation, and financial liability

It is my conclusion that this is an important oversight in the sections I read and with the Secretary of Interior's new comprehensive initiative, an area to explore to ensure the tribes' concerns are met.

Mitigation Measures: On page 1-1 the mitigation discussion is very amorphous. Early in the document, the document warns us that it may discuss mitigation, but that such mitigation is not required relative to NEPA ("mitigation measures if adopted")(Compare **EC6j-10**

this to CEQA which does require mitigation). On Page 1-11, the document states that the applicant will "[a]void sensitive resources whenever possible". Yet, the Indian Trust Responsibility involves "no harm, not whenever possible." (Elizabeth Homer, Homer Law, "Tribal Consultation Course," Duke University, 2010).

EC6j-10, cont.

The Resource Monitoring and Mitigation Plan described on page 2-19 requires qualified archaeologists, but there is no commitment to developing a discovery plan or any mitigation.

EC6j-11

California mitigation standards under CEQA require that "[i]f the final EIS/EIR shows...significant and unavoidable impacts (not mitigatable).... the County will need to adopt a "Statement of Overriding Considerations[1]", a high bar indeed and discussions with California may be productive to ensure that the obligations of CEQA are met in the federal agency decision making.

EC6j-12

1

Findings and Statement of Overriding Considerations

Findings required by CEQA are the conclusions made regarding the significance of a project in light of the impacts and mitigation measures that have been identified; they establish the analytical link between the CEQA document and a decision derived from the document.

CEQA requires that a public agency, when approving a project, make Findings for each significant environmental effect identified in the EIR, as described in the CEQA Guidelines Section 15091.The Findings should set forth the underlying rationale used by the decision maker to approve or deny the project. Specifically, the Findings must explain whether and why mitigation measures and project alternatives have been accepted or rejected.

For each significant effect and alternative, the lead agency should make one or more of the following Findings accompanied by a brief explanation of each Finding:

The lead agency may approve a project with unavoidable adverse environmental effects only when specific economic, legal, social, technological, or other considerations outweigh those effects. Section 15093 requires the lead agency to document and substantiate any such determination in a "statement of overriding considerations" as a part of the record.

The Findings should also include a general statement that a Mitigation Monitoring and Reporting Program has been adopted to ensure implementation of feasible mitigation measures identified in the EIR.

CONCLUSION:

The alternatives section should be improved to consider different sites and different ways to handle different infrastructure items to lessen environmental impacts. There needs to be a much more robust government-to-government consultation where tribal values are considered and to ensure that BLM meets its Trust Obligations prior to BLM (and the County) making a decision on the project. It is during this consultation process that necessary measures to mitigate the impacts (including total or partial avoidance) can and should be negotiated.

EC6j-13

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Ocotillo Wind Energy Facility
An examination of the Draft EIS/EIR section on Purpose and Need and the section on Alternatives with professional opinion as to whether the documents meet reasonable standards for such presentations. For your reference, my experience and follows:

I am the Principle of Owen L Schmidt LLC with more than 32 years of service with the Federal Government. I was a Senior Counsel with the U.S. Department of Agriculture, Office of the General Counsel in Portland, Oregon, where he advised the Forest Service, Natural Resources Conservation Service, and other USDA agencies in Washington and Oregon. I was also a Special Assistant United States Attorney in the District of Oregon. My specialty is the National Environmental Policy Act, including all aspects of compliance with its procedural provisions. Before joining USDA in 1991, I was an attorney for the Bonneville Power Administration, where he joined the legal staff after several years as an Environmental Specialist. I am a frequent author and lecturer on the National Environmental Policy Act.

COMMENT 1

A reasonable reader is looking for a straightforward 3-way relationship between a proposal for action, the underlying need for it, and alternatives that accomplish the same thing. In plain language it makes sense that a Federal agency would not propose to take action unless it were needed, and that a Federal agency would consider alternative actions that would meet the same need.

Graphically, this can be represented as a bulls-eye target, where the bulls-eye is the underlying need and arrows are the alternatives. Any alternative that meets the need is likely a reasonable alternative and any alternative that does not meet the need can be safely eliminated from detailed study. See Figure 1, below.

A reasonably adequate EIS/EIR would make this 3-way relationship reasonably clear, even if it does not employ plain language. For example, what can be depicted as a bulls-eye target might be called objective, purpose, goal, desired condition, underlying need, purpose and need, etc. Whatever the language, this 3-way relationship should be transparent.

The first problem this EIS presents to the reader is that the "underlying need" is anything but clear. It says on page 1-2 the BLM's "purpose and need for the Proposed Action is to respond to a FLPMA ROW application submitted by the Applicant ...." Stated in plain

EC6k-01

language, the underlying need is for a response to an application. That makes sense, in a way, because the reader can safely assume the applicant (Ocotillo Express) has submitted an application to BLM for ROW occupancy and use and there is a need for a BLM response. But that's not what it says on page 2-24:

> As discussed in the Purpose and Need (Section 1.1), the overall project purpose is "To provide a wind energy facility ranging in size from approximately 315 MW to 465 MW in Imperial County, California to assist California and its IOUs in meeting the State's Renewables Portfolio Standard (RPS) and GHG emissions reduction requirements, including the requirements set forth in Senate Bill (SB) 1078 (California RPS Program), Assembly Bill (AB) 32 (California Global Warming Solutions Act of 2006), and SB X1-2 to increase the State's Renewable Energy Standard to 33 percent renewable power by 2020.

EC6k-01, cont.

First, the statement on page 2-24 is not "as discussed" in Section 1.1. It is a different statement, moving from the need for a response to an application in Chapter 1 to a need for meeting a renewable energy portfolio standard and GHG emission standard here in Chapter 2. So .... which is it? A need for a response, or a need for meeting certain standards?

Second, Section 1.1 refers to a "purpose and need" whereas Section 2.4.1 refers to an "overall project purpose." These terms are not defined – even in the Glossary for this draft EIS/EIR (downloaded from the Web). Is the purpose and need the same sort of thing as the overall project purpose? Are both phrases intended to convey a sense of the underlying need? Are these terms intended to refer to separate elements of the EIS, or are they synonyms? They can't really be synonyms because they express different concepts. If they are separate elements, how should a reader regard them when the reader is looking for the underlying need for action?

EC6k-02

Third, all of this pertains to the need for BLM action. For this EIS/EIR, BLM is the lead Federal agency and BLM certainly has decisions to make. But there are also decisions that will be made by the US Department of Energy, the US Army Corps of Engineers, and the US Federal Aviation Administration (though the FAA's hazard determination might be exempt from NEPA – the EIS does not say). What is the need to which the Dept. of Energy and the Corps of Engineers are responding? On page 1-3 the draft EIS/EIR says "The purpose and need for action by the DOE is to comply with its mandate under EPAct 05 by selecting eligible projects that meet the goals of the act." This is likely false. It is the *proposal* by DOE *to comply with its mandate* by selecting eligible projects, perhaps. But what is the need underlying that proposal? Is it the need for action on an application for a loan guarantee from DOE in parallel to the need for BLM's action for action on an application? The draft EIS/EIR does not say. For the Corps of Engineers, the draft EIS/EIR states on page 1-4:

EC6k-03

> The overall project purpose is "To provide a wind energy facility ranging in size from approximately 315 MW to 465 MW in Imperial County, California."

Thus the Corps apparently sees an underlying need for a wind energy facility of a certain size in a certain location. In short, "The basic project purpose for the proposed action is 'Energy Production.'" Page 1-4. In context this is important for the Corps to determine whether the project is water dependent (it isn't). This is likely false, as well, in the NEPA

context. The *proposal* is to provide a wind energy facility of a certain size in a certain location. The *proposal* is energy production. But neither of those are Corps' proposals. The Corps is, presumably, proposing to grant or issue a CWA §404 permit for certain dredge and fill which will be part of the project. The *underlying need* for that action, in parallel with BLM's need once again, could be the need for action on such a permit application. The draft EIS/EIR doesn't say so.

EC6k-03, cont.

Fourth, there are also State and County government actors for which this is a joint EIS/EIR. The EIS is for Federal agencies and NEPA; the EIR is for CEQA in California. The California Department of Fish and Game may take action on an application for an Incidental Take Permit (page 1-7). Imperial County may take action on an application for a Conditional Use Permit, on a variance for structure height, a General Plan amendment, and a zone change (page 1-7 – though it isn't clear that these are 4 separate actions). The underlying need for any of these actions by State actors is not stated in this draft EIS/EIR.

EC6k-04

Fifth – and surely the most significant –there is no evidence for any of this. Government cannot just say "there is a need for x," period, now we're done. Hardly. Government has to show the rational basis for any of its conclusions. If there is a need for action on an application, there should be some evidence that there is an application (or will be). That should be easy to provide, but has not been provided. Apparently the Government in this draft EIS/EIR takes the position that it does not have to prove its statements. The question of proof is much tougher if the reader is to take the other statements of underlying need. If there is a need for a wind energy facility of a certain size in a certain location, as it says, certainly there is no evidence for that need. If there is a need for energy production, there is no proof for that here. If there is a need for meeting a renewable energy portfolio standard and GHG emission standard, as it says, certainly there is no evidence for this either. What is the standard, what is the performance now, what will the performance be if the proposed action is taken? None of these questions are answered. What is necessary is evidence that would show the reader the need is *bona fide*. The statements are true. The Government has done its homework. None of this is present in this draft EIS/EIR.

EC6k-05

In my professional opinion, this draft EIS/EIR is seriously flawed at the outset by giving no statement of underlying need for each action by each agency. Even if the reader presumes that for each agency there is an underlying need for action on an application to the agency, and that's why the agency is proposing to do what it is proposing to do, there is no evidence this is true. And there are too many needs for all of this to make sense. If the reader is to presume there is a need for energy, or a need for a wind energy facility, or a need for renewable energy, or a need based on GHG performance – none of this is explained. It is the essence of an arbitrary or capricious agency to state a conclusion without a rational connection to its supporting evidence. There is no supporting evidence for any of the variety of underlying needs in this draft EIS/EIR.

EC6k-06

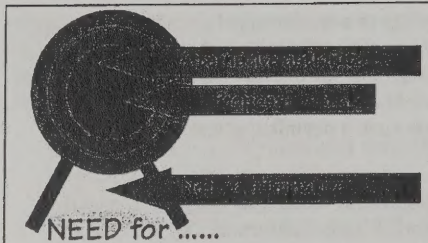

Figure 1. Agencies propose action to meet a need for action. Alternative actions that meet the same need are likely reasonable alternatives. Any suggested alternative that does not meet the need can safely be omitted from detailed comparison.

COMMENT 2

Without a clear statement of underlying need it should not be possible to assess whether the alternatives are reasonable. "When the purpose is to accomplish one thing, it makes no sense to consider alternative ways by which another thing might be achieved." *City of Angoon v. Hodel,* 803 F.2d 1016, 1021 (9th Cir.1986). Thus the reader will first have to figure out for themselves what it is that the agency is trying to accomplish or achieve, then it might be possible to assess the alternatives.

Assuming there is a need for action on an application to the BLM for ROW occupancy and use, as it suggests in the "purpose and need" section on page 1-2, then what are the alternative ways to meet that need? According to the draft EIS/EIR, there are 6 alternatives – the first of which is the proposed action alternative. Pages 2-21 through 2-25. But are these really alternative ways to meet the need?

No, these are not 6 alternatives ways to meet the need. Alternative 1 is the proposed action and it provides for 155 wind turbine generators (page 2-21). Alternative 2 is the same except that it provides for only 137 wind turbine generators (page 2-22). Alternative 3 is also the same except that it provides for only 105 wind turbine generators (page 2-23). Alternative 4 is the well-known and necessary no-action alternative, where presumably the ROW application would be denied (though on what grounds it would be denied is not stated) and the land would continue under current management (page 2-24). Alternative 5 is the same as 4 except that BLM would proceed with a Land Use Plan amendment to bar future development of wind energy at this site (page 2-25). Alternative 6 is the same as Alternative 4 except that BLM would proceed with a Land Use Plan amendment to allow future wind energy at this site (page 2-25). See Figure 2.

EC6k-07

There is no obvious relationship between the alternatives considered in detail and what the BLM is trying to accomplish or achieve. In other words, there is no straightforward relationship between a proposal for action, the underlying need for it, and alternatives that accomplish the same thing. "NEPA requires full disclosure of the adverse environmental impacts of the proposed development, as compared with alternative ways of accomplishing the same thing at the same site." *Pit River Tribe v. Bureau of Land Management,* 306 F.Supp.2d 929, 937-38 (E.D. Cal. 2004) (reversed on other grounds *Pit River Tribe v. U.S. Forest Service,* 469 F.3d 768 (9th Cir. 2006)).

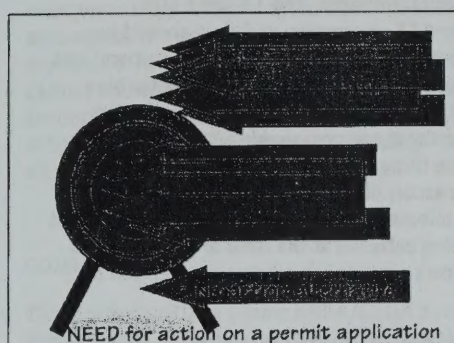

Figure 2. This draft EIS/EIR considers 5 action alternatives, including the proposed action alternative. A sixth alternative is the no-action alternative. Six other alternatives were eliminated from detailed comparison.

The first 3 alternatives are variations of the same concept: 155, 137, or 105 wind turbine generators. Now, if the application is for a development of 155 wind turbine generators, then the other 2 alternatives do not achieve what was intended by the proposed action. The reader does not know the truth of this because there is no evidence of what the application calls for. See Comment 1, above. It is plain to see these are different, and it is plain Alternatives 2 and 3 are alternatives to the proposed action (Alternative 1). But the proper question is whether these are alternative ways to achieve the same thing that was intended by the proposed action. The draft EIS/EIR doesn't answer this question.

EC6k-08

The last 2 action alternatives will either amend the Land Use Plan to ban future wind development, or allow future wind development. What they have in common that Alternative 4 does not have is a Land Use Plan amendment. Now, the reader doesn't know what the application calls for because the evidence is not provided in this draft EIS/EIR. See Comment 1, above. The reader does not know for sure what the agency is trying to accomplish. But it is beyond imagination that the application would call for a Land Use Amendment such as either of these 2 alternatives would accomplish. If that is the case, then the last 2 alternatives are not actually alternatives, or, if they are alternatives, then the need to which the 5 action alternatives respond is completely unknown. Either way, this is a serious flaw in this draft EIS/EIR.

EC6k-09

It is telling what BLM says about the alternatives: "Alternatives considered in the EIS/EIR are based on issues identified by the BLM as well as comments received during the public scoping process." Page 2-1. Yes, alternatives based on "issues." But if that is the case, if alternatives are based on "issues," then why does the agency have a "purpose and need" statement up front to lead the reader into believing the alternatives are based on a statement of what the agency is trying to accomplish or achieve – the purpose and need? Why does the agency say at the beginning of Chapter 2 that alternatives are screened on the basis of whether they fulfill "most of the purpose, need, and objectives identified in Chapter 1 of the EIS/EIR"? Page 2-1. Which is it? Alternatives based on "purpose and need" or alternatives based on "issues"? This draft EIS/EIR says it both ways, but apparently does not follow through with either way. Either way, this is a serious flaw in this draft EIS/EIR.

EC6k-10

Surely an agency has the power and perhaps the duty under NEPA to develop alternatives to the proposal that have lesser adverse environmental impacts. The 137 and 105 alternatives avoid some of the adverse effects of the 155 alternative and thus should be considered mitigation alternatives. The 137 alternative would "avoid sensitive cultural and biological resources," for example, and the 105 alternative would require "fewer turbine foundations/crane pads," meaning less ground disturbance (page 2-23). Well and good. What the reader cannot know, however, is whether these are *reasonable alternatives* to begin with, reasonable ways to accomplish the same thing, because the reader has not seen evidence of what it is, exactly, that BLM is trying to accomplish. Even if the 137 and 105 alternatives would "mitigate" some of the adverse effects of the 155 alternative, they are not really alternatives if they have no real chance of being selected at the time of decision, and they have no real chance of being selected if they don't accomplish what was intended by the proposed action.

EC6k-11

It is also telling that on page 2-23 the draft EIS/EIR states that if Alternative 3 were selected at the time of decision, the wind turbine generators "would have to be 3.0-MW WTGs to meet the Power Purchase Agreement amount of 315 MW." Wow! That potentially changes everything. If that statement is true, and there is no evidence either way in this draft EIS/EIR, then the need for action is the amount and kind of power generation that will fulfill the Power Purchase Agreement. This becomes the true need for action because the applicant will adjust its actions to accomplish this. This is what is intended to be accomplished, if that statement is true. This means Chapter 1 is bogus, that the need is for action on an application. This means the language in Chapter 2 about the alternatives being based on "issues" is bogus. This means Alternatives 5 and 6 are bogus, because they have nothing to do with meeting the terms of a Power Purchase Agreement. This means this EIS/EIR should be all about generating the amount and kind of power (the kind that meets GHG emissions standards) in the Power Purchase Agreement. This is all about fulfilling a Power Purchase Agreement, possibly. This means the "other types of energy projects" eliminated from the alternatives, page 2-37, possibly should not have been eliminated – meaning solar and wave and tidal energy and conservation-side management are possibly alternatives that will accomplish the same thing – *i.e.*, an amount of electric power that will meet GHG emission standards. This statement, if true, alters the fundamentals of this draft EIS/EIR in such a significant way that only a revised document could produce a reasonably adequate NEPA/CEQA compliance.

EC6k-12

In my professional opinion, this draft EIS/EIR is seriously flawed because the action alternatives have no rational relationship to the stated need for action. Yes, they are alternatives *to the proposal*. Anything that is not the proposal is an alternative *to the proposal*. But they are not obviously alternative ways to accomplish the same thing. It appears that on page 1-2 after stating a need for action on an application for a ROW occupancy and use, BLM turned from that never to refer to it again. The contents of Chapter 1 bear no relationship to the contents of Chapter 2, and vice versa. There is no coherent story line that threads the draft EIS/EIR, to lead the reader to understand what is proposed, why it is proposed, and alternative ways to accomplish the same thing. Starting in Chapter 1 with a proposal for a right-of-way, by the end of Chapter 2 this draft EIS/EIR looks like it possibly should have been all about green electricity. The reader has to guess, which means the text is not clear, which itself is a flaw. Staying with the story line that the underlying

EC6k-13

need is for action on a permit application, then Alternatives 5 and 6 bear no obvious relation to the need for action. These are alternative things to do, yes, but they do not accomplish the same thing as the proposed action. Even Alternatives 2 and 3, downsized versions of Alternative 1, do not accomplish the same thing – necessarily – but the reader cannot know for sure because there is no evidence of what exactly is supposed to be accomplished. The draft EIS/EIR presents a broken story line, shifting from a need for action on a ROW application to – possibly – a need for green energy. A broken story line is no story line at all.

EC6k-13, cont.

COMMENT 3

This draft EIS/EIR is a joint NEPA/CEQA document. As a Federal EIS it is intended to inform the decisions of the lead agency, BLM, plus the discretionary decisions of the DOE and the COE. As a CEQA EIR it is intended to inform the discretionary decisions of California agencies subject to CEQA.

Whatever the need for BLM's action – whether it is the need for action on a ROW application, or a need for green energy to comply with a Power Purchase Agreement – these would not be the need for DOE or COE action, or the actions of the California agencies. So, what is the need for these other actions?

EC6k-14

The draft EIS/EIR does not tell the reader anything about the need for actions by any agency other than BLM – if it even does that. This draft EIS/EIR could be called a *compound document*, meaning there are a number of proposals all going forward at once each with their own actors and descriptions and rationale. This is, of course, encouraged in multiple ways by the NEPA regulations. Amassing a number of related actions is expected to promote coordination among agencies and efficiency by writing only one NEPA/CEQA document. But all this coordination and efficiency does not excuse any lack of substantive content. The reader should still expect to see exactly what actions are proposed, why they are proposed, and alternative ways to accomplish the same thing.

The DOE has a pending loan guarantee application, apparently (page 1-3). What is DOE proposing to do? This draft EIS/EIR does not say, but the reader might presume the DOE is proposing to grant or approve the loan guarantee. Why would DOE do this? This draft EIS/EIR says nothing about the underlying need. There are citations to authorizing legislation, but there is no information in this draft EIS/EIR as to what DOE is trying to accomplish with this proposal. It would matter greatly to the content of this draft EIS/EIR if DOE were trying to stimulate the American economy, trying to promote green energy, or trying to promote certain technologies. There is language on page 1-3 that suggests any of these is possible. This draft EIS/EIR does not tell the reader which are operative in this case. Perhaps all are operative. If DOE were trying to promote green energy, for example, this could be relevant to what BLM said about its need for action. Perhaps this should have been a green energy EIS/EIR, rather than a ROW EIS/EIR. The reader is left to guess.

EC6k-15

The COE has a pending application for a CWA §404 permit, apparently (pages 1-3 and 1-4). What is their proposal? It doesn't say. Assuming they are proposing to grant or approve the permit, why would they do that? The COE can deny a permit on the basis of the public

interest, presumably, so why is it in the public interest to grant this one? Do they have alternatives? Perhaps there is a crossover between the downsized Alternatives 2 and 3, and what the COE may wish to accomplish? This draft EIS/EIR simply doesn't tell the reader anything about any of this.

EC6k-15, cont.

Imperial County has a pending application for a General Plan amendment, apparently (page 1-7). What does the application ask for, and what does Imperial County propose to do about it? What alternatives does Imperial County have at their disposal? California Department of Fish and Game has a pending proposal for an Incidental Take Permit. What do they propose to do about this? What are their options? This draft EIS/EIR simply doesn't tell the reader anything about any of this. There is generic, encyclopedic information on pages 1-12 and 1-13 about the legal authorities of the State agencies, but nothing about how those apply to this instance.

EC6k-16

In my professional opinion, this draft EIS/EIR is seriously flawed for not carrying through with all the agencies, all their proposals, all the reasons behind their proposals, and all the alternatives to all the proposals. By voluntarily amassing the actions of each of the agencies, by creating a compound and joint EIS/EIR, the lead agency has bitten off quite a mouthful. Tough. A compound EIS/EIR is more difficult to write, perhaps, than one that is not compound. But the reader still has the same questions and the same rules still apply. What are they proposing to do, why would they propose to do that, and are there any other ways to accomplish what they are trying to accomplish? None of these questions are answered for any agency other than BLM, and it doesn't seem they are answered for BLM either.

EC6k-17

COMMENT 4

Only a revised draft EIS/EIR will suffice.

There are such significant flaws in this draft EIS/EIR that it must be revised and circulated once again as a draft for comment before proceeding to a final EIS/EIR. A revised EIS/EIR is necessary to comply with the public notice and comment provisions of NEPA and the NEPA regulations. *Ecology Center v. Austin*, 430 F.3d 1057, 1067-68 (9th Cir. 2005) (Where, as here, "the information in the ... EIS was so incomplete or misleading that the decisionmaker and the public could not make an informed comparison of the alternatives, revision of an EIS may be necessary to provide 'a reasonable, good faith, and objective presentation of the subjects required by NEPA.'" *Animal Def. Council v. Hodel*, 840 F.2d 1432, 1439 (9th Cir.1988) (quoting *Johnston v. Davis*, 698 F.2d 1088, 1095 (10th Cir.1983)), amended by 867 F.2d 1244 (9th Cir.1989)). See also *Western Watersheds Project v. Kraayenbrink*, 538 F.Supp.2d 1302, 1314 (D. Id. 2008) (EIS is not adequate for Bureau of Land Management's (BLM) revisions to nationwide grazing regulations for federal lands); *Center for Biological Diversity v. Bureau of Land Management*, 422 F.Supp.2d 1115, 1161-62 (N.D. Cal. 2006) (EIS failed to adequately assess environmental consequences of OHV use on endemic invertebrates in the Imperial Sand Dunes Recreation Area).

EC6k-18

There are only 4 kinds of changes an agency can make between the draft and final EIS, one of which is to "[s]upplement, improve, or modify its analysis." 40 CFR 1503.4(a)(3). The defects in this version of the draft EIS/EIR, however, are beyond remediation because

essential information is missing. If supplied for the first time in a final EIS/EIR there would have been no opportunity for interested and affected agencies and members of the public to comment and express their concerns about this essential information.

Reviewers of this draft EIS/EIR have had no chance to look at the evidence of what is in the ROW application. No chance to consider the evidence for whether there is, perhaps, actually a need for green energy, or a need for 155 wind turbine generators. No chance to consider the evidence for why alternative sources of green energy (solar, wave, tidal, etc.) should not be considered as alternatives. No chance to consider why Alternatives 5 and 6 are deemed to be alternatives, when they do not apparently accomplish what Alternative 1 is intended to accomplish – because the reader does not know for sure what Alternative 1 is intended to accomplish. None of this can be considered because none of this is presented in the first 2 chapters of this draft EIS/EIR. [NOTE: There is slim chance that any of this missing evidence would be supplied by any of the remaining portions of this draft EIS/EIR – which are voluminous and outside the scope of this review.]

EC6k-18, cont.

In my professional opinion, this draft EIS/EIR is so seriously flawed that the public and agency review function cannot have been adequately performed. A revised draft EIS/EIR is mandatory for compliance with NEPA (and almost certainly with CEQA as well). As the court stated in the 2006 BLM case in the Northern District of California: "Where the information contained in the initial EIS was so incomplete or misleading that the decision maker and the public could not make an informed comparison of the alternatives, revision of the EIS may be necessary to provide a reasonable, good faith, and objective presentation of the subjects required by NEPA." This is the situation here.

COMMENT 5

You asked me to recommend whether additional review may be advantageous. I conclude that such review would be advantageous, using the methodology I have developed for reviewing the so-called "cumulative impacts" in a NEPA document (equally applicable to an EIS/EIR) that is easy to follow and completely reveals whether an agency followed the law.

My method simply adds one increment of environmental impact to other relevant increments to derive the so-called "cumulative" impact. My method is shown on the table below, which resembles a stacked column graph or a table or a spreadsheet. For each adverse environmental consequence revealed in the NEPA document I would check to see whether it showed the increment caused by the proposed action (box 1), the increment already present in the "affected environment" (box 2), and whether any reasonably foreseeable future actions would add an increment (box 3). Box 4 shows whether the agency investigated the possibility that the adverse consequence can be avoided. Box 4 shows one kind of alternative, mitigation not included in the proposed action. 40 CFR 1508.25(b)(3). The second box from the top shows whether the agency disclosed the grand sum total of all potential cumulative sources of all increments – the so-called cumulative impact. The top box shows a regulatory cap, if applicable, so the reader can readily grasp whether the cumulative impact of the proposed action meets whatever standards may apply.

Method for review of cumulative impacts analysis.

Regulatory cap, if applicable		50
Grand sum total of all increments		45
4. Mitigation not included in action to avoid the consequence		-5
3. Caused by reasonably foreseeable future action		0
2. In affected environment		40
1. Increment caused by proposed action		10
	Adverse consequence	**Sample**

A proper "cumulative impacts analysis" would add the increment caused by the proposed action to what is already present in the existing environment (which includes the consequences of past and other present actions), to the increment caused by reasonably foreseeable future actions, as may be modified by mitigation not included in the proposed action – all of which will produce a grand sum cumulative total of some intensity. If there is any constraint or cap or regulation the analysis should include a comparison where the reader learns whether the so-called "cumulative impact" complies with the constraint or cap. To illustrate, the "Sample" column shows the proposed action would cause 10, which would be incremental with 40 in the affected environment. In this example, there are no reasonably foreseeable future actions that add any increment, but mitigation not included in the action could lower the total by 5. This yields a sum total of 50 without optional mitigation, or 45 with mitigation. Because the regulatory threshold is 50 in this illustration, the reader can readily see that mitigation is not necessary to achieve compliance, but some of the adverse effects can be avoided if optional mitigation were adopted.

What follows is a representative example for whether this draft EIS/EIR adequately informs the reader – and thus eventually the decisionmaker – of the cumulative impacts from the proposed action, and whether those impacts can be avoided. The premise of this method is that a reasonable reader should be able to readily fill in this table for each adverse consequence.

EC6k-19

Burrowing owl, pages 4.21-4 et seq.

Regulatory cap, if applicable	??
Grand sum total	The cumulative impact would be significant under CEQA; The measures specific to the proposed OWEF would render the proposed OWEF's contribution to the cumulative impact less than significant under CEQA (page 4.21-39)
4. Mitigation not included in action	??
3. Caused by reasonably foreseeable future action	??
2. In affected environment	16 occupied burrows were observed; there are approximately 6,400 pairs within the cumulative impacts analysis area (page 4.21-39)
1. Caused by action	Construction noise and night lighting could impact breeding behavior or reproductive success; 4 or more occupied burrows would be directly impacted; construction would degrade foraging habitat; O&M activities have the potential to affect burrowing owls (page 4.21-12); Resident and migratory bird ... species are at risk of collision with the 155 WTGs, (page 4.21-13); Decommissioning and reclamation activities associated with the Proposed Action would result in direct temporary and permanent losses of wildlife species habitats and indirect effects on habitats and species (page 4.21-21)
Increment	**Burrowing owl**

EC6k-19, cont.

The reader cannot fill in this table on the basis of what is in this draft EIS/EIR. It is easy to see that the proposed action (Alternative 1) will cause miscellaneous adverse consequences to Burrowing Owls and their habitat (box 1). There are Burrowing Owls in the affected environment (box 2), of course, but it is not possible for a reader to add up the score even at this point. If there are 6400 pairs there now, how many will be there once the proposed action is in place? This draft EIS/EIR doesn't tell us. It gets no better as we go up the column. Nothing detectable is said about reasonably foreseeable future actions, whether there are any, what they are, and what consequences they may incrementally contribute (box 3). Apparently there has been no investigation into the question of whether any of these adverse consequences can be avoided (box 4). True, every adverse consequence has already been reduced or minimized or mitigated to some extent. That is part of box 1. Box 4 inquires into whether anything further can be done. Can these adverse consequences, even though minimized, be absolutely avoided? This draft EIS/EIR doesn't say. Whether the cumulative impact is significant or not significant (this draft EIS/EIR says both) isn't the

question. This is an EIS/EIR, where significant impacts may be expected. The question is what the grand sum total, which this draft EIS/EIR doesn't tell. Nor can a reader fill in the top box, which may well be that there is no regulatory cap in this instance. But this draft EIS/EIR doesn't so inform the reader.

What we have here, essentially, is box 1 and box 2. Yes, there are Burrowing Owls, yes they will be adversely affected, period, now we're done. Hardly. What the reader should expect in this draft EIS/EIR is the information to be able to readily fill in all 6 boxes. There is a legal citation for each box. Failure to fill in each box is a patent failure to comply with NEPA (and most likely CEQA as well).

EC6k-19, cont.

In my professional opinion, this draft EIS/EIR is seriously flawed on the question of cumulative impacts. One spot check (Burrowing Owls) showed no compliance. My experience with BLM EISs is that this may be what the reader should expect throughout. This isn't NEPA compliance and this shortcoming should be exposed to BLM.

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December 7, 2011

Conclusions Regarding the Adequacy Of The EIS for the Proposed Ocotillo Wind Energy Facility

This letter report records the results of a review that was performed to determine the adequacy of the environmental impact statement (EIS) for the proposed Ocotillo Wind Energy Facility.

Professional Qualifications

Eccleston is a *Certified Environmental Professional* and is listed in both *Who's Who in America* and *Who's Who in the World* as an international expert in the areas of the National Environmental Policy Act (NEPA) and environmental impact assessment. This experience includes writing 8 books on NEPA, energy, and environmental policy, 70+ papers on NEPA and environmental policy issues, and teaching NEPA classes. He has worked closely with many environmental lawyers in preparing EISs and on NEPA lawsuits, and has a good understanding of NEPA case law. The following examination is based on 25 years of experience, much of it with the US Department of Energy, preparing EISs and alternative studies for energy-related projects.

Questions

This letter report specifically addresses the following two questions:

1. Are the purpose and need, as set forth in Chapter 1, properly formulated?
2. Are a reasonable range of alternatives evaluated in Chapter 2?

Review

Owen Schmidt is a noted attorney specializing in NEPA. The following examination was performed using Schmidt's technique, "The Statement of Purpose and Need Defines the Scope of Reasonable Alternatives." Under this model, the statement of purpose and need defines a defensible basis for determining the scope and range of alternatives evaluated in an EIS. When properly applied, this model has been repeatedly upheld by the courts. The model is explained in detail in the book, *NEPA and Environmental Planning.*[1]

The following examination has been performed in terms of how NEPA compliance officers and potential litigants may view the EIS. It is also based on

[1] Eccleston C.H., *Environmental Impact Statements, A Comprehensive Guide to Project and Strategic Planning, pp92-97, John Wiley & Sons Inc. (2008).*

years of experience gained reviewing and preparing energy-related proposals. Before discussing the results of this review, it should be noted that this EIS involves an applicant applying for federal authorizations/approvals. In addition, it involves multiple cooperating agencies and multiple statutes that must all be complied with.

Statement of Purpose and Need

The *Statement of Purpose and Need* (SPN) is convoluted, alluding to multiple needs/purposes. It does not clearly spell out the underlying need for the proposed action. **EC6I-01**

The expressions "purpose" and "need" are not equivalent terms but, in fact, are two distinct and separate concepts. The difference between these two concepts is explained in the book, *Environmental Impact Statements.* The SPN never clearly distinguishes between these two concepts. Most importantly, the SPN does not succinctly meet the Council on Environmental Quality's Regulatory requirement to "...briefly specify the *underlying* purpose and need to which the agency is responding in proposing the alternatives including the proposed action" (40 CFR §1502.13). As a final note, some of the verbiage and statements throughout Section 1.1 are confusing or not 'on target' and would benefit from a revision to this section; additionally, I noticed some small technical errors such as referring to the CEQ NEPA Regulations as "guidelines." **EC6I-02**

It is critical, that the SPN be correctly crafted as it drives the range of reasonable alternatives that must be examined in the EIS (Schmidt's Model). While the SPN does not adequately reflect CEQ's regulatory requirement, it could be corrected and re-written is relatively short order. Such a change would affect the range of reasonable alternatives considered in Chapter 2 (see below).

Range of Reasonable Alternatives

The SPN, as currently written, has resulted is a more significant problem. The following section examines the adequacy of the range of reasonable alternatives.

Problems: As just stated, a correctly crafted SPN is essential to the goal of ensuring that an appropriate *range of reasonable alternatives (Alternatives)* is identified and evaluated. Experience indicates that an incorrectly defined SPN often leads to an inadequate examination of the Alternatives for a project. A careful review of Chapter 2 leads me to conclude that this section does not adequately evaluate a "reasonable range of alternatives" as expected by the courts and by the CEQ NEPA Regulations. **EC6I-03**

The range of alternatives as currently written also appears to be biased in favor of the proposed action. This could create problems, and lead to increased costs and/or extensive delays in terms of a review by: (1) the Federal agency's

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NEPA compliance officers; (2) the public; and (3) those who wish to challenge the project.

As a final note, there appeared to be some potential problems with the comparison and summary of the impacts. It would require an examination beyond the scope of this task to verify if this indeed the case.

EC6l-03, cont.

Recommendation

It is recommended that the EIS be revised. Both the SPN and range of reasonable Alternatives need to be revised. In terms of re-writing the Alternatives section, additional alternatives should be examined to demonstrate that a full range of alternatives, consistent with Schmidt's Model, have been investigated . If carefully thought out and orchestrated, this re-work may not result in a substantial delay.

EC6l-04

Charles Eccleston

Charles H. Eccleston, *Certified Environmental Professional* Date

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December 8, 2011

Re: Ocotillo Wind Energy Facility Draft EIS/EIR June 2011
DOI Control No. DES 11-20; SCH 2010121055

Dear Mr. Kenna and Ms. Havens:

I have been asked by the Viejas Office of Legal Affairs to review and comment on the Draft EIS/EIR for the proposed Ocotillo Wind Energy Facility (OWEF) project in western Imperial County, California. This letter is submitted pursuant to your letter of November 1, 2011, to Viejas, extending the comment period deadline for tribes.

Introduction

By way of relevant background, I am an attorney in private practice, and have been practicing environmental law and litigation in California for nearly twenty years. Each of these years has included work in Imperial County, including review of the County of Imperial's General Plan and obtaining the denial of the proposed Glamis Gold Mine. I have hiked its desert, and have attended site visits to the project area. My undergraduate degree is in Biology and I have served on the Boards of several conservation organizations including the Trust for Public Land's California Advisory Board. My law practice focuses on protecting and preserving tribal cultural resources, biologically sensitive lands and parklands through environmental litigation and land use policy, legislation, project and planning consulting for American Indian Tribes and entities, citizen groups, local and national conservation and historic preservation organizations, and nonprofits throughout San Diego, Riverside, San Bernardino and Imperial Counties using CEQA, NEPA and other local, state and federal laws. I played a key role in the development and passage of important tribal heritage resource laws in California including: SB 22

(mining backfill regulations, 2004), SB 18 (tribal consultation, 2004), SB 922 (confidentiality, 2005) and AB 2641 (burials bill, 2006).

In this letter, I identify many procedural and substantive shortcomings with the Draft EIS/EIR and its technical support documents. I have also reviewed all the documents in the Viejas submission. It is also my opinion, that local, state and federal agencies have sufficient information in the record to DENY the proposed action; however, should any of the agencies desire to further consider the proposal, the many identified inadequacies in the Draft EIS/EIR and in meaningful consultation with tribal governments must be resolved prior to that consideration to inform that decision. This data, in my opinion, would necessarily constitute significant new information and new substantive analysis, that would require recirculation of the environmental documents. **EC6m-01**

Issues of Concern under CEQA and other California state and local laws[1]

Pursuant to Section 15270(a) of the CEQA Guidelines, CEQA does not apply to projects which a public agency disapproves. Projects may be disapproved when environmental impacts are not outweighed by the project's benefits and would create negative effects for the region, as is the case here. **EC6m-02**

Cumulative Effects

I concur with the submitted comments of the USEPA that the cumulative effects with Sunrise Powerlink, which crosses the proposed OWEF site, have not been adequately studied, particularly given the construction delays associated with Powerlink. I also believe that the biological impacts from Powerlink are greater than those disclosed in the Powerlink EIR, particularly the effects on golden eagles given the ongoing eagle harassment that is occurring during project construction. I also believe the impacts to tribal cultural resources were also misrepresented in the Powerlink EIR as the cultural resource identifications and evaluations and tribal consultations were improperly deferred and not completed at the time that the project or its environmental documents were approved. **EC6m-03**

Alternatives Analysis

It is my opinion that the Alternatives section is inadequate under CEQA as the two build project alternatives both share essentially the same project components (substation, switchyard, O&M facility, batch plant, rail yard, MET towers) and offer only relatively minor variations on the number of turbines (137 and 105 compared to the project's 155). (ES-5.) Importantly, the project and its two build alternatives share very similar unavoidable adverse impacts in type and magnitude. (Table ES-1.) **EC6m-04**

The Draft EIS/EIR states that the No Project Alternative is the Environmentally Superior Alternative under CEQA because it would avoid the project impacts. Among the two build alternatives, the 105 turbine project is selected as the Environmentally Preferred Alternative. The section goes on to state that while the adverse impacts would be reduced, this alternative would not fully meet the project

[1] The categories used in this letter are for convenience and are not meant to be mutually exclusive to local, state or federal jurisdiction.

objectives as it would produce 315 MW (150 fewer MW than the largest project configuration presented). CEQA, however, does not mandate that all project objectives must be met. (*Laurel Heights Improvement District v. Regents of the University of California* (1988) 47 Cal.3d 387, 400 (alternatives must be discussed even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly). (Guidelines, § 15126, subd. (d)(3).)

EC6m-04, cont.

A reasonable range of off-site alternatives should have been studied to meet the MW target. Such alternatives may have greatly reduced the nature and extent of adverse impacts proposed by the current build alternatives, yet added to the renewables portfolio. In my opinion, the alternatives considered, but eliminated from detailed analysis, were prematurely eliminated from consideration and without sufficient rationale regarding feasibility. A revised analysis focusing on other types of energy projects, private lands, and alternative BLM-administrated land should have been studied and considered in detail.

EC6m-05

Social Impacts Caused by Physical Effects

The EIR suggests that the County must determine whether the project is consistent with the policies of Imperial County General Plan, conforms to applicable regulations and standards within County ordinances and make findings pursuant to CEQA that the project's impacts to the physical environment have been mitigated to the degree feasible.

The document misstates CEQA. CEQA is not limited simply to mitigating physical impacts but also the social impacts caused by physical impacts to the environment. Some EIR preparers erroneously believe that CEQA addresses only narrowly construed "environmental" issues, not the social, demographic or economic issues raised by environmental justice concerns. However, Section 15131(b) of the CEQA Guidelines expressly addresses social and economic effects by authorizing the analysis of such effects in determining the significance of a physical change caused by the project. Further, Section 15065(d) states that an agency shall determine that a project may have a significant effect on the environment if the project will cause "substantial adverse effects on human beings, either directly or indirectly." This would include the adverse impacts to tribes' spiritual values and practices as expressed in the many tribal comments on this project's effects on tribes and tribal members.

EC6m-06

Environmental Justice

Remarkably, the Draft EIS/EIR states that there are, "No State or local regulations, plans or standards related to environmental justice" applicable to this project. (3.5-3.) In fact, there are state environmental justice standards and many would apply to this project. A good place for the EIR preparers to start, would be the CalEPA Environmental Justice Program homepage.[2] CEQA does indeed

EC6m-07

[2] Go to: <http://www.calepa.ca.gov/envjustice/>.

not only allow for, but requires, the analysis of impacts on communities.[3] The environmental document must be revised to reflect state environmental justice guidance and that this project would disproportionately affect local Indian tribes, a minority population, and adversely impact their cultural sites and religious practices.

EC6m-07, cont.

Water Supply

Ensuring an adequate and reliable water supply to projects is becoming more and more important in California. Courts are increasingly looking to see enforceability and transparency in discussion of water supply in environmental documents.

The proposed action requires up to 50 acre-feet of water for construction and asserts it would be obtained from an unidentified private groundwater well near Pine Valley, approximately 50 miles west of the proposed project, as the groundwater aquifer upon which the proposed project sits is currently in a state of long-term overdraft and therefore unavailable. (4.19-3 to 4.19-4.) During operation and maintenance, the Draft EIS/EIR states that about 0.19 acre-feet per year would be required and would either be trucked to the project site or would be obtained from the same unidentified well(s) in Pine Valley. (4.19-12.)[4] The Draft EIS/EIR also admits that it is reasonably anticipated that a water source would be needed for soil conditioning and dust suppression, but offers no quantification. (4.19-16.)

EC6m-08

The project's Draft EIS/EIR does not meet even minimal standards under the California Water Code as it does not even attempt to quantify all phases of the project's water needs and does not have an identified, available or committed water supply for any of the project phases as indicated in the environmental document and by the comment letter on the Draft EIS/EIR from the County of San Diego which indicates it is not a reasonable likelihood that water will be coming from a Pine Valley source or meet project demands over 20 years. Also, the Draft EIS/EIR is internally inconsistent as the draw down impact would not be temporary, as the Pine Valley source is used, as discussed in the environmental document, for operations and decommissioning over the potential 40 year life span of the project – not just 3 years of construction.

EC6m-09

The document also fails to include a Water Supply Assessment (WSA) pursuant to SB 610 (2002). The Draft EIS/EIR states that Imperial County has determined that the proposed project does not meet the definition of "project" per SB 610. (3.20-13.) However, the document admits that, "This decision is not an authoritative interpretation of the types of projects that should be required per SB 610; other Lead Agencies may choose to make different decisions on similar projects." (Id.) The project could be classified as a proposed industrial plant or park occupying more than 40 acres of land thereby requiring a WSA. It is an abuse of discretion for Imperial County not to require a WSA for this project.

EC6m-10

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[3] See, "Addressing Environmental Justice in California," Gregory King, <http://www.calepa.ca.gov/envjustice/Documents/2003/Appendices/AppendixA.pdf>. It is incorporated by reference here in its entirety.

[4] The Draft EIS/EIR is also unclear about whether the proffered water supply source is one or multiple wells in Pine Valley.

On the water supply issue alone, the project must be rejected. The water source is so speculative it does not even rise to the level of "paper water." Should the applicant be able to identify an available water supply or contingent supplies, a supplemental environmental document will need to be circulated to ensure that impacts have been discussed and adequately considered. Moreover, the document must clearly disclose the additional traffic and visual impacts from trucking water and the additional visual impacts of possible water storage facilities to the project site depending on the supply options and methods available.

EC6m-11

Statement of Overriding Considerations

While I believe there are additional unavoidable adverse impacts, and in many cases that the magnitude of these impacts is even greater than stated in the environmental document, the Draft EIS/EIR itself notes unavoidable adverse impacts to air quality, noise, paleontological, vegetation resources, visual resources, wildlife resources (ES-15 through ES-16).

EC6m-12

The existence of unavoidable impacts does not preclude approval of a proposed project. However, if significant impacts exist that cannot feasibly be mitigated, the lead agency must determine that the unavoidable impacts are acceptable due to overriding considerations before approving the proposed project. The determination must be explained in a Statement of Overriding Consideration (SOC) that must set forth the agency's specific reasons for approving the project. Guidelines § 15093. An SOC is legally inadequate if it mischaracterizes the reasons for approval, fails to accurately reflect significant impacts or is not supported by substantial evidence in the record. *Woodward Park Homeowners Assoc. v. City of Fresno* (2007) 150 Cal.App.4th 683, 687; Guidelines § 15093. Viejas respectfully requests to be provided a draft of the SOC and any other candidate findings, prior to a decision being made on the project.

EC6m-13

Imperial County Permits

The Draft EIS/EIR states that approval of a conditional use permit and a variance will be required for structure heights (turbines and MET towers) as the height of these uses would vastly exceed what is otherwise allowed by about 350 feet. (ES-16.) Yet, the Lands and Realty section of the Draft EIS/EIR does not discuss the required findings. I do not believe that the required findings can be made based on the substantial evidence submitted in the Viejas comments and that found elsewhere in the project record.

EC6m-14

The required variance consists of satisfying the following four findings.[5] Viejas has questions and concerns about each of the four findings:

1) What special circumstances are applicable to the affected property that do not apply generally to the property or class of use in the same zone?

[5] Imperial County Ordinances, Title 9, Division 2: General Provisions, Section 90202.08A, Action on a Variance.

2) Viejas has submitted substantial evidence that the granting of the variance will be materially detrimental to the public welfare and injurious to the property in the zone and vicinity in which the property is located;

3) What special circumstances apply to the subject property such that strict interpretation of zoning laws would deprive the subject property or privileges enjoyed by other properties in the vicinity?

4) Viejas has submitted substantial evidence that the granting of the variance would adversely affect the general plan (including open space and desert residential use designations and environmental and cultural resources).

EC6m-14, cont.

The required conditional use permit consists of seven findings,[6] Viejas believes at least the following four of which cannot be made for the project: Finding A) Viejas has submitted substantial evidence that the granting of the variance would adversely affect the general plan (including open space and desert residential use designations and environmental and cultural resources); Finding E) Viejas has submitted substantial evidence that the project will be detrimental to the health, safety, and welfare of the public, the property and residents in the vicinity; Finding F) Viejas has submitted substantial evidence that the project violates several federal, state and local laws or ordinances; and Finding G) That the proposed use is granting a special privilege. The decision-making authority shall deny an application if it cannot make all of the required findings, which this application cannot do.

Failure to Initiate SB 18 Consultation

The Draft EIS/EIR states that implementation of the proposed project would require a General Plan amendment and zone change for a wind turbine generator on private property near Ocotillo. (5.2.) SB 18 requires that cities and counties contact, and consult with, California Native American Tribes before adopting or amending a General Plan, or when designating land as Open-Space, for the purpose of protecting Native American Cultural Places. The Legislature's intent is to establish meaningful consultation between tribal governments and local governments at the earliest possible point in the planning process, consider information early in the planning process to avoid potential conflicts, and enable tribes to manage and act as caretakers of cultural places.[7]

EC6m-15

There is no indication in the Draft EIS/EIR that SB 18 consultation for the proposed action has been initiated by the County; Viejas has not been consulted on the General Plan amendment, to date. The substance of the consultation must be reflected in the project's environmental documentation for the

[6] Imperial County Ordinances, Title 9, Division 2: General Provisions, Section 90203.09, Action on a Conditional Use Permit.

[7] For more guidance, please see the Governor's Office of Planning & Research, including the following sources which are incorporated by reference: SB 18 Overview, <http://opr.ca.gov/docs/SB_18_Overview.ppt>; and State of California "Tribal Consultation Guidelines" Supplement to General Plan Guidelines, April 15, 2005, <http://www.opr.ca.gov/s_localandtribalintergovernmentalconsultation.php>.

County's decision on the project. This omission must be rectified prior to any action being taken on the project for the decision to be fully supported with substantial evidence.

EC6m-15, cont.

Failure to Disclose Administrative Remedies

The Draft EIS/EIR outlines the administrative remedies under the federal regime, but fails to disclose state and local remedies. (5-9.) This must be remedied and the information available for public review.

EC6m-16

Issues of Common Concern under Federal and California Law

Tribal Cultural Resources

For the reasons so well stated in the other submissions by Viejas, its consultants and others, the Draft EIS/EIR is grossly in error in concluding that there are no unavoidable adverse impacts to cultural resources. Evidence in the record disputing this significance conclusion include: that the area has been determined eligible for the California and National Registers of Historical Places by affiliated tribes; the area has been designated as a sacred place under Executive Order 13007 by the Viejas Tribal Council; that many tribal informants have described the area as a Traditional Cultural Property (TCP); and that the project area has religious and spiritual values to tribal peoples.

Contrary to the conclusions of the Draft EIS/EIR, substantial evidence shows that there would be adverse construction, operation, maintenance and decommissioning related impacts as the eligible property, a sacred place or TCP, would NOT be avoided in any of these project actions.

EC6m-17

Moreover, the conclusion that "Construction impacts on unknown resources would be mitigated" is unsupported by the record. Particularly where, as here, there is a high likelihood of encountering unrecorded ancestral human remains and grave goods. It is well known that the sands in this area shift, alternatively concealing and revealing such resources.

EC6m-18

Further, the statement that "Indirect impacts due to increased access or erosion would be mitigated" is also without substantiation. In fact, there is no evidence that the proffered measures will be effective at mitigating – in whole or in the part – the anticipated impacts from 42 miles of new roads combined with the attractive nuisance that turbines and their infrastructure will pose. It is my observation over twenty years, in this desert, that BLM does not have the resources to manage, monitor and police the sensitive lands under its care and that developments such as this project will only add to the resource damage found elsewhere where other projects have been introduced. See, for example, National Trust for Historic Preservation (May 2006) *Cultural Resources on the Bureau of Land Management Public Lands: An assessment and needs analysis*, pages 27-28.[8] There is no indication that the mitigation measure to provide a vague funding source as stated in the Draft EIS/EIR would be adequate or sustained.

EC6m-19

[8] The report can be found at: <http://www.preservationnation.org/issues/public-lands/additional-resources/NTHP-BLM-Report.pdf>. It is incorporated by reference here in its entirety.

Finally, is there analysis of the aesthetic and recreational effect and the effect to the landscape as a whole, from shadowing by the tall turbines? EC6m-20

Biological Resources

Some sixteen vegetation communities are described in the Draft EIS/EIR and special status species listed but the environmental document does not consider it as a functioning ecosystem or analyses the impacts to that system. Based on a species count of the organisms described in the Draft EIS/EIR (although surveys were incomplete as described elsewhere in Viejas' comments), there is a high level of diversity in open desert without surface water. Once this system is interrupted, it will be unlikely to be reestablished to a similar level of functionality. EC6m-21

Lands and Realty

That the proposed project requires Plan Amendments from the governing federal and county plans, as well as a zone change and a conditional use permit at the County level, in and of themselves, demonstrate that potential and actual land use conflicts exist. Moreover, the project area is surrounded by a multitude of special land conservation designations. (See, for example, Figure 3.16-1.) Where is the analysis in the Draft EIS/EIR of the impacts on each of these areas and their special qualities? Based on the information in the record, the significance threshold must be revised to Unavoidable Adverse Impacts. EC6m-22

Mineral Resources

The Draft EIS/EIR states that sand and gravel would be required for access roads and concrete manufacturing. (Table ES-1.) What is the location of these borrow areas? It should be known that some borrow areas in Imperial County (and possibly other counties as well) are from culturally sensitive locations. It would cause additional adverse impacts should materials from such areas be introduced in the Project Area, and would add to the cumulative effects to cultural resources. EC6m-23

Purpose and Need

Given the foregoing, the Purpose and Need, Applicant's Objectives, assertion that the project will minimize environmental impacts and land disturbance by avoiding sensitive environmental areas, recreational areas and wildlife habitats as claimed by the applicant cannot stand. (ES-4.) Similarly, the Purpose and Need, CEQA Objectives assertion that the project will ensure minimal environmental impacts is not supported by substantial evidence (ES-4). EC6m-24

Permanence of Impacts

The Draft EIS/EIR gives the illusion that the project and its impacts will somehow be "temporary" or that some of the resources on the site could be "retrieved," "in the event" that the project is decommissioned. (4.22-1.) This ambiguous language regarding the intensity and duration of the project does not support a finding of no or a less than significant irreversible and irretrievable commitment of resources. Moreover, given that a five-foot thick portion of each concrete turbine foundation would EC6m-25

remain below the ground surface after decommissioning (4.19-17), and the evidence in comments on the Draft EIS/EIR that soil disturbance in the desert can last up to 300 years, I believe the project's impacts, on the whole, should be classified as a permanent, irreversible and irretrievable commitment of desert resources (including biological, visual, soils and cultural resources). **EC6m-25, cont.**

Greenhouse Gasses

The proposed project's primary benefit is an asserted incremental contribution to the reduction in demand for fossil fuel used to generate electricity. (4.22-1.) However, without a retirement of "dirty" energy tied to the introduction of this "renewable" energy source, how can it be concluded with any certainty that the project will actually contribute to the reduction of greenhouse gasses, versus simply introduce more energy into the grid? The Draft EIS/EIR falls short of committing that greenhouse reductions will be verifiable or quantified. (4.3-2.) Yet, without substantiation, claims that the project's ability to potentially generate "green" power for 30 or 40 years is a "long term" benefit (4.23). Without such assurances or certainty, the purported benefits of the project, the centerpiece of the proposed action, may be illusory. The resolution of this issue, also has implications for whether the project will have growth inducing impacts. **EC6m-26**

Moreover, the Draft EIS/EIR does not appear to consider the release of sequestered carbon in the desert soils and caliche that would be disturbed by the project. This, along with the more commonly considered carbon emission sources (i.e., machinery during construction) would further offset any purported reduction in demand for fossil fuel used to generate electricity. **EC6m-27**

Other Asserted Project Benefits

Other asserted project benefits in the Draft EIS/EIR are not substantiated. These include the assertion that the proposed project would provide jobs to local workers. Based on observations reactive to the Powerlink project (including informal license plate surveys and discussions with workers), many of the jobs were not provided to local people but instead to out of state workers. Without a firm and quantified commitment to hire local workers, this "benefit" may not be claimed by the applicant to offset project harms. **EC6m-28**

Issues of Concern Under NEPA/Federal Law

Alternatives

The Draft EIS/EIR states that the federal lead agency preferred alternative is the Proposed Action. (ES-6.) But there is no accompanying analysis to support the selection. As noted in other submissions by experts retained by Viejas, the range of alternatives examined is impermissibly narrow, as a result of the convoluted but ultimately circular definition of purpose and need (the purpose of the project is apparently to construct the project, and the need is to approve it). **EC6m-29**

The EIR suggests the threshold issue for a federal decision is whether the application area should remain undesignated relative to wind energy development or be designated suitable or unsuitable for such development. (ES-4.) Given the substantial evidence submitted in comment letters, it is clear that the

application area is unsuitable for wind development given its cultural, biological, botanical, recreation, visual and other qualities. This unsuitability for industrial development has been recognized for at least 20 years as the area was designated Class L, or Limited Use, in the CDCA Plan.

EC6m-29, cont.

Environmental Justice

Given the adverse impacts to tribal religious and cultural values, the Draft EIS/EIR's conclusion that there will be no unavoidable adverse impacts to environmental justice under the federal framework is also unsupported. Based on the extensive substantial evidence provided by the tribes and tribal members, this significance conclusion must be revised to acknowledge that unavoidable adverse impacts will occur during construction, operation, maintenance and decommissioning; including direct, indirect and cumulative impacts. Viejas and its members will suffer disproportionate adverse environmental impacts if the project is permitted.

EC6m-30

Standing

Based on the evidence submitted in comments, there is no question that the project's injury to tribes and tribal members has been shown; that their lives will be less enjoyable and that truly they will suffer in their cultural, religious, aesthetic and recreational satisfaction if the area in question becomes environmentally degraded because of the proposed project.

EC6m-31

Conclusion

Based on the forgoing, it is our opinion that Alternative 5, no BLM issuance of a right-of-way grant and no County approvals, combined with BLM approval of a land use plan amendment to exclude wind energy development on the site of the Proposed Action is the only appropriate and legal option to take.

Also, given the biological, botanical, cultural and visual resource values of the site, I would also recommend that the area be designated an Area of Critical Environmental Concern (ACEC) and that the funding and development of a management plan for this ACEC be prioritized.

EC6m-32

Thank you for considering these opinions and comments. We look forward to receiving written responses to all of the comments submitted by Viejas and its consultants.

Very truly yours,

Courtney Ann Coyle

Courtney Ann Coyle
Attorney at Law

Campo Band of Mission Indians

Chairwoman Monique La Chappa
Vice Chairwoman Michelle Cuero
Secretary Annah Ceballos
Treasurer Marcus Cuero
Committee Steven Cuero
Committee Harry Cuero
Committee Benjamin Dyche

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CENTRO FIELD OFFICE
EL CENTRO, CA

January 25, 2012

Margret Goodro
BLM El Centro Office
1661 S. 4th Street
El Centro CA 92243

Mr. James Kenna
BLM State Director
20800 Cottage Way, Suite W-1623
Sacramento, CA 95825-1886

Dear Ms. Goodro and Mr. Kenna:

Please accept this letter on behalf of the Campo Kumeyaay Nation regarding the proposed Ocotillo Express Wind Energy Project. Campo opposes this project and urges the BLM to deny approval of this project.

As you have heard from a number of other tribes, we have continuing cultural associations with the Ocotillo area and its natural and cultural features, plants and animals, and the visits across the landscape. This area is culturally and religiously significant to the Kumeyaay, the Qechaun and the Cocopah peoples. There are a number of cremations throughout the project area as well as ceremonial sites. All of the tribal cultural resources that exist within this cultural landscape are significant to who we are as a people and simply cannot be replaced.

We have developed wind energy on our lands and generally support the development of renewable energy. However, we believe that the development of renewable energy projects need to be compliance with applicable state and federal law and cannot threaten to irreparably harm biological and cultural resources that are cultural and spiritually significant to us, particularly on such a large scale.

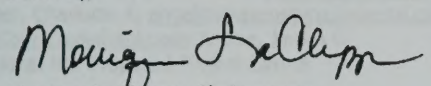
EC7-01

Campo opposes this project in this place because the proposed project area lies within a rich landscape that is culturally and religiously significant to us and the other tribes and, if constructed, the proposed project will cause irreparable harm to those tribes and, resources of great cultural value them. We urge the BLM to choose deny approval of this project and protect this place forever by placing it into an Area of Critical Environmental Concern and directing the development of a management plan that recognizes and protects these tribal cultural values.

Thank you for your attention to this matter. Please contact me with any questions.

36190 Church Rd., Suite 1 Campo, CA 91906 Phone: (619) 478-9046 Fax: (619) 478-5818

Sincerely,



Monique La Chappa, Chairwoman

Campo Kumeyaay Nation

Comment Letter EC8

From: Kimberly Mettler [mailto:KMettler@VIEJAS.com]
Sent: Monday, February 13, 2012 9:44 AM
To: Zale, Thomas; 'Simmons, Carrie L'; Nancy Brown (nbrown@achp.gov); Dwight Dutschke (ddutschke@parks.ca.gov); Perry, Cedric C; meris.bantilan-smith@usace.army.mil; lp13boots@aol.com; patriciavalenzuela@co.imperial.ca.us; nativespirit91; Angela Santos; Jeff Riolo; John Bathke; courtcoyle@aol.com; frankbrown6928@gmail.com; Jill McCormick (culturalres@cocopah.com); Ken Wilson (ken.wilson20@yahoo.com); Goodro, Margaret L; Hunter, Charlotte A; 'angelinahavens@co.imperial.ca.us'
Cc: 'CourtCoyle@aol.com'; Kenna, James G
Subject: Proposed Project Layout

Dear Tom:

As you requested during Thursday's meeting with the BLM, please accept these comments on behalf of the Viejas Band of Kumeyaay Indians. We reserve the right to provide additional comments at a later time.

As was clearly expressed to you and to Pattern during last week's meeting, it is unreasonable and unfair to have provided a map to tribes with no additional relevant information as a part of an alleged consultation, and then require our comments to be submitted on incredibly short notice. As you are aware, it was only Thursday (February 9) that we were provided any information about the maps or the newest proposal by Pattern. It should have been no surprise that the information presented only served to emphasize the *lack* of information that was provided to us prior to the meeting, and gave rise to a number of questions that must be answered by BLM and Pattern before any meaningful evaluation by the tribes can be considered.

EC8-01

We respectfully request that the deadline for comment on the newest Pattern proposal be no earlier than the next group consultative meeting and when we have been provided the information and made the site visits discussed during the meeting.

Thank you for your consideration.

Kimberly R. Mettler, General Counsel

Viejas Office of Legal Affairs
Viejas Band of Kumeyaay Indians
619-659-1710 (Office)
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Comment Letter EC9

From: Jill McCormick [mailto:culturalres@cocopah.com]
Sent: Monday, February 13, 2012 1:29 PM
From: Jill McCormick [mailto:culturalres@cocopah.com]
Sent: Monday, February 13, 2012 1:29 PM
To: 'Kimberly Mettler'; Zale, Thomas; Simmons, Carrie L; 'Nancy Brown'; 'Dwight Dutschke'; Perry, Cedric C; meris.bantilan-smith@usace.army.mil; lp13boots@aol.com; patriciavalenzuela@co.imperial.ca.us; 'nativespirit91'; 'Angela Santos'; 'Jeff Riolo'; 'John Bathke'; courtcoyle@aol.com; frankbrown6928@gmail.com; 'Ken Wilson'; Goodro, Margaret L; Hunter, Charlotte A; angelinahavens@co.imperial.ca.us
Cc: CourtCoyle@aol.com; Kenna, James G
Subject: RE: Proposed Project Layout

Mr. Zale,

The Cocopah Cultural Resource Department concurs with the statements made by Ms. Mettler. As I stated at the February 9th meeting, merely providing a map and a revised project timeline without any context, then asking us to comment on it one day following the meeting is absurd and not in line with meaningful consultation. We also respectfully request that the comment period be extended to the date of the next consultative meeting and that in the mean time a true effort be put forth on BLM's behalf to provide the consulting parties with more information on the newly proposed layout of the wind turbines and provide responses to our numerous comment letters on the overall project and the MOA.

EC9-01

H. Jill McCormick, M.A.
Cultural Resources Manager
Cocopah Indian Tribe
14515 S. Veterans Dr.
Somerton, AZ 85350
Cell: 928-503-2291
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Appendix P

Water Supply Assessment

Appendix P

Water Supply Assessment

Water Supply Assessment
Ocotillo Express Wind Farm

June 8, 2011

Prepared for:

County of Imperial

940 Main Street

El Centro, Ca 92243

Prepared by:

NEIL O. ANDERSON
AND ASSOCIATES

902 Industrial Way

Lodi, Ca 95240

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Acronyms and Abbreviations

af	acre-feet
afy	acre-feet per year
BLM	U.S. Department of Interior Bureau of Land Management
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
County	County of Imperial
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
FDB	Food and Drug Branch
gpd	gallon per day
gpm	gallons per minute
GPS	Global Positioning System
H&SC	Health and Safety Code
HA	Hydrologic Area
HR	Hydrologic Region
O&M	Operations and Maintenance
PWS	Public Water System
SB 610	Senate Bill 610
SDCWA	San Diego County Water Authority
taf	thousand acre-feet
UWMP	Urban Water Management Plan
WSA	Water Supply Assessment

1 Executive Summary

This report and Water Supply Assessment (WSA) has been prepared to assist Imperial County in meeting the requirements of Senate Bill 610 (SB 610) for the Ocotillo Express LLC Wind Farm (proposed project) in Imperial County. The proposed project is located on approximately 15,000 acres, the majority of which are lands administered by the U.S. Department of Interior Bureau of Land Management (BLM), and a small portion of which will be leased from a private land owner. The proposed project will be constructed in two phases that will include 158 wind turbines, access roads, an Operations and Maintenance Building, and other support facilities.

Imperial County is the lead agency for the California Environmental Quality Act (CEQA) and no Public Water Supplier (PWS) has been identified. Although Imperial County did not request the WSA, it is being prepared voluntarily to assist in the determination of adequacy of water supply for the proposed project and as supporting documentation to the Environmental Impact Report (EIR).

The proposed project will not be connected to or receive water from a PWS. Water for construction demand (50 acre-feet), toilet flushing (0.18 acre-feet per year) and fire suppression (0.03 acre-feet) will be purchased from a private well located near Pine Valley in San Diego County. The well water provided for toilet flushing is not a confirmed source of potable water, and no water will be used for hand washing. Hand sanitizers will be provided on site.

The private well is located in the Barrett Lake Hydrologic Area, which is within the Tijuana River Valley Watershed. The well may be drawing water from the underlying alluvial aquifer and/or fractured rock found deeper below. The groundwater basin that is ultimately affected by water being drawn from this well is the Tijuana Groundwater Basin. This is located within the South Coast Hydrologic Region (HR) and is not considered to be in a state of groundwater overdraft due to current or proposed future uses. The basin is non-adjudicated and the well owner has no restrictions on the yield from his well.

The private well is located within the Campo-Cottonwood Sole Source Aquifer (SSA) Designated Area. However, the proposed wind energy project is not located at this aquifer. The proposed project lies above the Ocotillo/Coyote Wells SSA; thus, the *Hydrological and Environmental Hazard Assessment* addresses the construction and operational conditions that may be reviewed by the Environmental Protection Agency under the SSA Program, specific to the Ocotillo/Coyote Wells SSA.

Operational demand also includes drinking water (0.01 acre-feet per year) which will be purchased from a privately-owned bottled water plant/distributor licensed by the California Department of Public Health (CDPH) Food and Drug Branch (FDB). Drinking water will be delivered in 5-gallon bottles for use in water coolers. No other operational demands are anticipated.

2 Introduction

This report presents the Water Supply Assessment (WSA) prepared for the Ocotillo Express Wind Farm project (proposed project) in accordance with Senate Bill 610 (SB 610). The project site encompasses approximately 15,000 acres, the majority of which is located on U.S. Department of Interior Bureau of Land Management (BLM) administered lands and a small portion (26 acres) of which is private property. As part of the California Environmental Quality Act (CEQA), this project is undergoing an Environmental Impact Report (EIR). This report and WSA are furnished as a supporting documentation to the EIR.

2.1 Senate Bill 610

Senate Bill 610 became effective January 1, 2002, and requires cooperation and interaction between the CEQA lead agency and the water supplier for a proposed project. The intent of SB 610 is to strengthen the process by which local agencies determine the adequacy and sufficiency of current and future water supplies to meet current and future demands.

Imperial County is the CEQA lead agency and no Public Water Supplier (PWS) has been identified. However, Imperial County has not specifically requested that a WSA be completed. It is unclear as to whether or not the proposed project qualifies as a "project" as defined by California Water Code §10912 (a) and (b). California Water Code 10912 (a)(5), states that a "project" includes a "proposed industrial, manufacturing, or processing plant, or industrial plant planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area." The proposed project encompasses more than 40 acres, but the water demands are minimal and it is uncertain as to whether or not the proposed project qualifies as a "project" under the definition of Water Code §10912. However, the WSA is voluntarily being prepared as an informational document to assist the lead agency in evaluating the adequacy of water supplies for the proposed project.

2.2 Sole Source Aquifer Program

The Sole Source Aquifer Program was established under the Safe Drinking Water Act in 1974. It is used by communities to help prevent contamination of groundwater from federally-funded projects. The SSA Program allows for Environmental Protection Agency (EPA) review of any project that is federally-funded to determine if there is a potential for contamination of the sole source aquifer.

Water for construction, fire suppression, dust control, and toilet-flushing will be supplied by a private sealed well with hydrant located near Pine Valley, within the Campo/Cottonwood SSA Designated Area. The existing private well does not constitute a project subject to review by EPA under the SSA Program and therefore, no additional analysis has been performed. Water will be withdrawn from this existing well within its historic usage and as allowed by the determination of the well as a legal nonconforming use for a water distribution business (see Appendix 1).

The proposed wind energy project is located inside the boundaries of the Ocotillo/Coyote Wells SSA. The *Hydrological and Environmental Hazard Assessment* was developed to address the construction and operational conditions that may be reviewed by the EPA under the SSA Program.

3 Project Description

The proposed project will include 158 turbines, approximately 41 miles of new access roads, an electrical collection system (to collect power from each wind turbine generator), a substation, an interconnection switchyard, an Operations and Maintenance (O&M) building, and underground power utilities throughout. Each of the turbines will have a hub height of 262.5 feet, a rotor diameter of 331.3 feet, a total height of 428.1 feet and a column width of 15 feet. These turbines will weigh approximately 350 tons. Construction will be completed in two phases. Phase 1 will include up to 137 wind turbines, the substation, switchyard, collection system, access roads, and the O&M building. The final phase will include additional wind turbines, access roads, and collection system for the remaining wind turbines. Figure 1 illustrates the proposed project site location.

The proposed project is located within the Ocotillo/Nomirage Community Area as defined in the Imperial County General Plan.

3.1 Proposed Project Construction Demand

During construction it is anticipated that a maximum of 50 acre-feet (af) of water will be needed over the entire construction period. This construction demand will be provided with a one-time purchase of construction water from a private well located near Pine Valley in an unincorporated portion of San Diego County. Water for construction purposes will be used primarily for concrete batching, dust control, and soil compaction. Potable drinking water for construction workers will be delivered daily by construction companies on their own trucks.

3.2 Proposed Project Operational Water Demands

Demand for proposed project operations includes water for drinking, toilet flushing, and fire suppression.

Drinking water demand is nominal at 0.5 gallon per day (gpd) per employee. With seventeen (17) full-time employees, estimated drinking water demand is 8.5 gpd which equals 3,102 gallons per year, or 0.01 acre-feet per year (afy). Estimated water deliveries for drinking water total 3,129 gallons per year (0.01 afy) to meet that demand. The water will be supplied by a Bottled Water Distributor licensed by the California Department of Public Health (CDPH) Food and Drug Branch (FDB).

Water for toilet flushing is estimated at 0.18 acre-feet per year (afy). The private well near Pine Valley, which is not considered a potable supply, will provide this water. Water will not be provided for hand washing; hand sanitizers will be provided for employee use.

An additional 0.03 afy (10,000 gallons) for fire suppression will be stored in an on-site tank. The water for fire suppression will also be obtained in a one-time purchase from the private well near Pine Valley.

No other water demands are anticipated.

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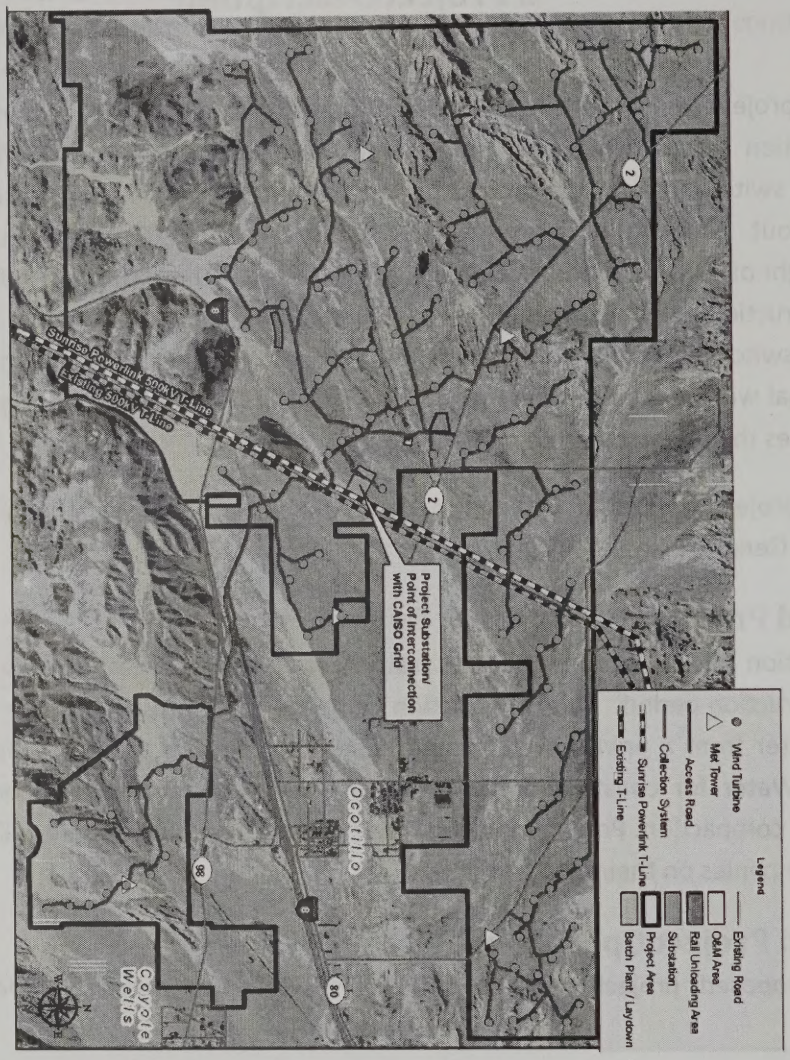

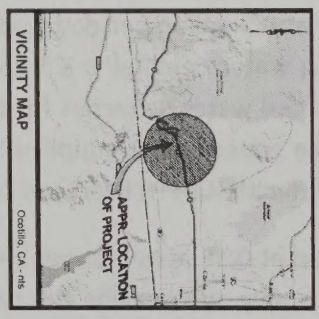

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SITE LOCATION AND VICINITY MAP
HYDROLOGICAL & ENVIRONMENTAL HAZARD ASSESSMENT
OCOTILLO EXPRESS WIND FARM
IMPERIAL COUNTY
OCOTILLO, CALIFORNIA

	REV	DATE	DESCRIPTION	APPR.
1.				
2.				
3.				
4.				
5.				

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4 Water Supply Assessment for the Ocotillo Express Wind Farm

4.1 Introduction

Roles of the Lead Agency and the Water Supplier

The County of Imperial is the CEQA Lead Agency responsible for evaluating the environmental impacts of the proposed project in compliance with CEQA, certifying the EIR, and approving the project. Should a PWS be identified, it is responsible for preparing the WSA. No PWS has been identified.

4.2 Compliance with Provisions of the Water Code

Senate Bill 610 (California Water Code Sections 10910-10915) requires that a WSA include the following:

- A description and quantification of existing and planned future water supplies;
- A description of the reliability and vulnerability of the water supply during a normal water year, single dry water year, and multiple dry waters year over a 20-year projection period;
- Documentation of the water supplier's water rights, contracts, and/or entitlements, and detailed information such as capital financing programs or regulatory approvals;

The following analysis presents the WSA for this proposed project in compliance with SB 610.

Is the project subject to California Environmental Quality Act [California Water Code Section 10910(A)]

The project is subject to CEQA and is undergoing an EIR. The County of Imperial is the lead agency and no PWS has been identified. Imperial County has not determined that a WSA is required for the proposed project; however, this WSA is being prepared voluntarily as supporting documentation to the EIR.

Is there a current Urban Water Management Plan?

There is no current Urban Water Management Plan (UWMP) for the identified water suppliers.

Identify existing water supplies for the proposed project [California Water Code §10910(D)]

The water for proposed project will be supplied by a private well located near Pine Valley in San Diego County. This well will supply the construction demand, operational demand for toilet flushing, and water for fire suppression.

Operational water demands for drinking water will be purchased from Bottled Water Distributors licensed by the California Department of Public Health (CDPH) Food and Drug Branch (FDB). The water will be delivered in 5-gallon bottles and stored in water coolers on site.

Document water rights

The private well near Pine Valley is designated a Water Distribution Business subject to the Nonconformity Regulations of the San Diego County Zoning Ordinance Section 6852 and Section 6864 (Existing Groundwater Extraction Operations). A copy of the Determination of Nonconforming Use is included in Appendix 1. There are no limitations on the volume of groundwater extractions for this well.

The operational demands for drinking water will be purchased from privately owned FDB licensed bottled water distributors located in Imperial County or nearby in San Diego County. The sources for bottled water companies can vary greatly and may include groundwater, municipal water, natural springs, and artesian wells. Possible water suppliers include Sparkletts, El Oasis Water Company, Roman's Water, or D&M Water Company.

4.3 Supply Reliability Analysis

Population, climate, and supply and demand information will be presented for both the proposed project area and for the basin from which the proposed project demands will be supplied.

Population

There are no existing residents in the proposed project area. The water supply for the proposed project is located between Pine Valley and Alpine in unincorporated San Diego County. Current and future population is combined for both cities and summarized in Table 1.

Table 1. Current and Future Population Projections for the Alpine and Pine Valley (combined).

Year	2008	2015	2020	2025	2030	2035
Population	19,248	19,549	20,358	22,311	23,873	25,994

Source: SANDAG, 2050 Regional Growth Forecast (data extracted on: 02/2011).Available at http://datawarehouse.sandag.org/ forecast demographics from Pine Valley and Alpine combined

Climate

Table 2 summarizes representative climate data for the proposed project area, including average monthly precipitation, temperature, and evapotranspiration (ETO). The proposed project area is located in an arid desert with hot, dry summers and mild winters. Annual average precipitation is less than three inches.

Table 2. Climate Data for Proposed Project Site

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Avg precip	0.51	0.36	0.31	0.05	0.03	0.01	0.06	0.32	0.36	0.35	0.17	0.43	2.96
Avg Temp	70.2	74.5	79.3	86.1	94	103.4	107.0	105.7	101.1	90.9	78.1	69.7	88.3
ETO	2.32	3.2	5.13	7.32	8.67	8.74	8.91	8.3	6.61	5.0	3.07	1.95	69.22

Sources: Precipitation and Temperature data from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC), El Centro 2 SWW Station; Evapotranspiration data from California Irrigation Management System (CIMIS), El Centro Station.

Table 3 summarizes representative climate data for the basin from which proposed project demands will be supplied, including average monthly precipitation, temperature, and evapotranspiration (ETO). Annual average precipitation is approximately 18 inches.

Table 3. Climate Data for Water Supply Location

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Avg precip	3.49	3.44	3.92	1.26	0.47	0.2	0.16	0.27	0.42	0.85	1.72	1.99	18.19
Avg Temp	54.1	55.2	55.8	59.5	62.9	69.3	74.7	75.9	73.5	66.8	59	54.3	63.4
ETO	2.13	2.14	3.36	4.61	5.21	6.30	6.70	6.81	5.29	4.12	2.76	2.13	51.56

Sources: Precipitation and Temperature data from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC), Alpine Station; Evapotranspiration data from California Irrigation Management System (CIMIS), Ramona Station.

4.3.1 Comparison of Available Water Supplies Versus Demand

Proposed Project Demands

The proposed project will require the following demands:

- Construction demand: 50 af
- Water for fire suppression: 0.03 af (10,000 gallons)
- Toilet flushing water demand: 0.18 afy
- Drinking water demand: 0.01 afy (3,102 gallons per year)

Water for construction will only be required during the construction period. Demand for fire suppression is anticipated only at the onset of the proposed project. Therefore, construction and fire suppression demands are listed in acre-feet. Construction demand (50 af) will be used primarily for concrete batching, soil compaction, and dust control. Drinking water during construction will be brought on site by construction companies for use by contractors. Water for fire suppression (0.03 af) will be stored on-site and used in case of fire for the duration of the project.

The operational water demands for the proposed project consist of drinking water for employees and water for toilet flushing. For drinking water, assuming a water ingestion of 0.5 gpd per employee, for 17 employees, the water demand is 8.5 gpd. The total volume of drinking water demand is 3,102 gallons per year, or 0.01 afy.

Water demand for toilet flushing, assuming 1.6 gallons per flush and 6 flushes per employee, is 0.18 afy. Water will not be used for hand washing. Hand sanitizers will be utilized at the proposed project site. No additional operational water demands are anticipated.

Available Water Supply

Two water supplies have been identified for the proposed project:

- An FDB licensed Bottled Water Distributor (for operational drinking water demands); and
- A private well Water Distribution Business located near Pine Valley in an unincorporated portion of San Diego County (for construction, fire suppression, and operational toilet flushing demands).

Drinking Water Supply

The water demands for drinking water for the proposed project will be purchased from water bottling plant/water bottle distributors licensed by the FDB, such as Sparkletts, El Oasis Water Co., D&M Water Co., or Roman's Water Co., or other licensed distributor. The water will be delivered in 5-gallon bottles and placed for use in water coolers at the proposed project site. Twelve (12) 5-gallon water coolers will be located on-site, for a total of 60 gallons per delivery, with estimated water delivery approximately once every 7 days.

Bottled water plants and distributors that operate and sell in California are governed by the following regulations:

- Health and Safety Code (H&SC)
  - Sherman Food Drug Cosmetic Law, H&SC Sections 111070 to 111198;
- Title 21, Code of Federal Regulations (21 CFR)
  - Beverages (Bottled Water): 21 CFR, Part 165.3 and 165.110;
  - Processing and Bottling of Bottled Drinking Water (Bottled Water GMP's), 21 CFR, Part 129;
  - Good Manufacturing Practices, 21 CFR, Part 110; and,
  - Food Labeling, 21 CFR, Part 101 and Part 102.33.

The quantity of bottled water and coolers required (625 bottles delivered per year, for 12 coolers) would typically service approximately 10 average households. Should a licensed FDB Bottled Water Distributor be unable to supply this amount, additional bottles will be secured from other licensed distributors as

required. The water supply to bottled water companies is unlikely to be affected by normal, single dry year, and multiple dry year events.

Water Supply for Construction, Fire Suppression, and Toilet Flushing

The private well near Pine Valley is not subject to groundwater pumping restrictions. Based on anecdotal data from the supplier, the well supply is unaffected by normal year, dry year, and multiple dry years conditions. Historically, the well has not experienced variation in supply even during drought years. Production from this well may only be limited by pumping (150 gpm) and storage (30,000 gallon tank). The well depth is approximately 200 feet below ground surface. It is cored and cased in upper alluvium near the surface and then fractured rock further below. The static water level is approximately 30 feet below ground surface. Water from this well is often used for construction demand for other projects and is not typically sold for human consumption; water quality information is not available for this well.

Although specific numbers for water supply for this well are unavailable, based on anecdotal evidence and historical use, the potential supply from this well is estimated to be approximately 121 afy (see Appendix 3). Existing demand from other users of this water supply may vary widely depending on season and construction projects; however, based on anecdotal evidence of historical water sales from this supplier, the estimated existing demand for the suppliers' other users is approximately 28 afy. For purposes of this analysis, this demand is estimated to grow at a steady rate for the next 20 years. Table 4 illustrates the operations demands over a 20-year projection period.

Table 4. Comparison of Water Supply and Demand over a 20-year Projection Period, for Normal, Single Dry, and Multiple Dry Years (afy)

	2012	2017	2022	2026	2032
Supply					
FDB Licensed Bottled Water Distributor	0.01	0.01	0.01	0.01	0.01
Private Well[1]	121	121	121	121	121
Total Supplies	121.01	121.01	121.01	121.01	121.01
Demand					
Other	28	33	38	43	48
Proposed Project (construction)	50[2]	0	0	0	0
Proposed Project (fire suppression)	0.03[3]	0	0	0	0
Proposed Project (toilet flushing)	0.18	0.18	0.18	0.18	0.18
Proposed Project (drinking water)	0.01	0.01	0.01	0.01	0.01
Total Demand	78.22	33.19	38.19	43.19	48.19
Difference (Supply minus Demand)[3]	42.79	87.82	82.82	77.82	72.82

[1]Estimated water supply available to the seller based on historical use and equipment limitations; however, the seller may or may not be withdrawing this supply from the well each year.

[2]One-time purchase for water for construction.

[3]One-time purchase for water for fire suppression (0.03 af = 10,000 gallons).

4.4 Groundwater Sources, Water Code §10910 (f)

The water supply for this proposed project includes groundwater; therefore, Water Code Section 10910 (f) requires that specific groundwater information be included in this WSA. Because there is no UWMP for this water supplier, detailed information and data on this groundwater source was compiled from a variety of resources, which are referenced below.

4.4.1 Basin Description [Water Code §10910(f)(1)]

The water supply for construction and operational demand includes groundwater from a private well located near Pine Valley in unincorporated San Diego County. The well is located in the Barrett Lake Hydrologic Area (911.3) of the Cottonwood-Tijuana Hydrologic Unit (18070305) (see Figure 2), within the larger Tijuana River Watershed (see Figure 3). Generally, wells in this area of San Diego County pull from fractured rock aquifers. These types of aquifers tend to have lower storage capacity in steeply sloped upland areas, with potentially higher storage in valley areas. Often, fractured rock aquifers are overlain by a layer of alluvium or weathered bedrock, which can further increase storage capacity of the aquifer (County of San Diego, 2007).

There is no groundwater basin directly beneath this private well. This hydrologic area feeds into Barrett Lake, which is a main recharge source for the Tijuana Groundwater Basin, which is located further west along the coast. This basin is designated as a groundwater basin within the DWR Bulletin 118, which is referenced in State Senate Bill 610 as a guidance document for assessing water supply. Because the waters from the well site (and hydrologic area) eventually serve to recharge the Tijuana Groundwater Basin, information on the Tijuana Groundwater Basin has been presented in this report. As required by State Senate Bill 610 the groundwater basin that is most affected by the proposed water supply site must be assessed. For this reason we are assessing the Tijuana Groundwater Basin even though it is not directly beneath the well location site.

Although no specific groundwater management plan has been created for Tijuana Groundwater Basin, the Binational Watershed Advisory Council is the lead group which oversees the vision for the overall Tijuana River Watershed basin (Appendix 2).

The Tijuana Groundwater Basin is located within the greater South Coast Hydrologic Region (HR). Listed below, for the remainder of Paragraph 4.4.1, is the description of the Tijuana Groundwater Basin excerpted directly from the Department of Water Resources (DWR) Groundwater Bulletin 118 (2006).

Tijuana Groundwater Basin

- Groundwater Basin Number: 9-19
- County: San Diego
- Surface Area: 7,410 acres (11.6 square miles)

Basin Boundaries and Hydrology

The Tijuana Groundwater Basin underlies the portion of the Tijuana River Valley that lies within California. The basin's southern boundary is the international border with Mexico. The eastern and northern boundaries are the contacts with semi-permeable Pleistocene and Pliocene marine deposits. The western boundary is the Pacific Ocean. The intermittent Tijuana River and several ponds are hydrologic surface features in the basin.

Water Bearing Formations

The water-bearing units in the basin are the San Diego Formation (SDCWA, 1997) and Quaternary age alluvium. The marine terraces can also be water bearing; however, these deposits are frequently above the regional groundwater surface.

Quaternary Alluvium

The most productive unit in the basin is the alluvium which consists of river and stream deposits of gravel, sand, silt, and clay. The thickness of the alluvium is less than 150 feet (Izbicki 1985) and averages about 80 feet thick (SDCWA 1997). Wells yield as much as 2,000 gpm, but the average yield is 1,000 gpm (SDCWA 1997). Groundwater in this unit is unconfined and the specific yield is about 15 percent (SDCWA 1997).

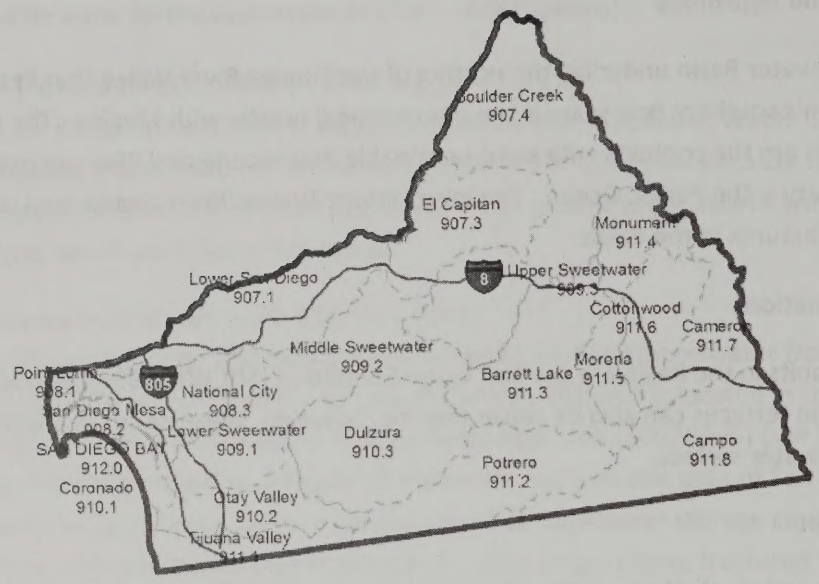

Figure 2. Southern San Diego Ground Water Unit Boundaries Map showing the individual Barrett Lake Hydrologic Area (911.3). Not to be confused with the Tijuana River Watershed boundary map listed below. (Source: San Diego Regional Water Quality Control Board, Southern San Diego Ground Water Unit, http://www.swrcb.ca.gov/rwqcb9/water_issues/programs/ground_water_basin/southern.shtml .

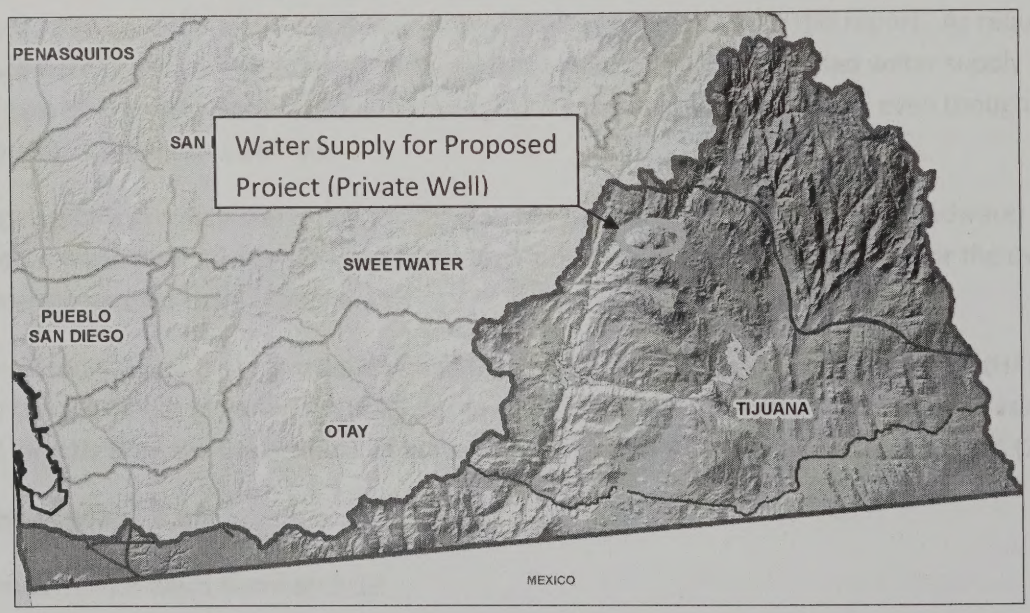

Figure 3. Tijuana River Watershed (United States Portion), with location of water supply for proposed project denoted. (Source: San Diego County Water Authority (SDCWA) *Integrated Regional Water Management Plan*, October 2007)

San Diego Formation

This unit consists of Pliocene age well-sorted, medium to coarse sand, silty and clayey sand, sandy silt, and sandy clay (Huntley and others 1996). Thickness of this unit ranges to at least 1,700 feet in the basin (Dudek and Associates 1994). Well yields average about 350 gpm with discharges as high as 1,000 gpm being recorded. Groundwater in the San Diego Formation is confined with a storage coefficient of about 0.001 (SDCWA 1997).

Restrictive Structures

The La Nacion fault and several smaller faults cross the basin. The smaller faults may be associated with the Rose Canyon fault, located 20 miles north of the basin (Wiegand, 1970). Faulting has probably contributed to difficulty in correlating deep well logs in the basin (Izbicki 1985). It is unknown whether these faults impede groundwater movement within the basin.

Recharge Areas

Recharge to the basin is mainly from the Tijuana River and controlled releases from the Barrett and Morena Reservoirs in San Diego County and Rodriguez Reservoir in Mexico. Some applied irrigation waters recharge the basin by deep percolation and discharges from septic tanks also contribute to Hydrologic Region South Coast recharge. The irrigation water accounts for more than one third of the recharge in the basin (DWR 1984).

Groundwater Level Trends

Water levels declined in the alluvial aquifer during the 1950s through the early 1970s, eventually reversing the historical westward groundwater flow. This reversal allowed seawater to infiltrate the alluvial aquifer and move eastward, degrading the groundwater quality and the productivity of agriculture in the western part of the valley (Dudek and Associates 1994). Changes in pumping in the 1970s allowed water levels to rebound. By the early 1990s, groundwater had resumed its historical flow direction (Dudek and Associates 1994).

Groundwater Storage

Groundwater Storage Capacity. Groundwater storage capacity is about 50,000 to 80,000 af (DWR (1984).

Groundwater in Storage. DWR (1984) assumed a 5,000-acre surface area for the basin, and estimated storage to be between 50,000 and 80,000 af. However, these estimates are based on slightly different basin boundaries than in this report.

Groundwater Budget (Type A)

San Diego County Water Authority (1997) reports about 1,500 af/yr of groundwater is pumped from the Quaternary alluvium and extraction data for the San Diego Formation are not available.

Groundwater Quality

The alluvium contains water of sodium chloride character. TDS content for this water typically ranges from 1,120 to 3,620 mg/L, although, less than 1,000 mg/L is found beneath some side canyons (Izbicki 1985). Groundwater in the San Diego Formation is sodium chloride in character and TDS content ranges from 380 to 2,360 mg/L (Izbicki 1985). Chloride and sulfate concentrations have exceeded the MCL in some wells in the basin (Izbicki 1985). The MCL for aluminum, barium, lead, selenium, and silver concentrations are exceeded individually in some wells in the basin (Dudek and Associates 1994).

4.4.2 Is the Basin Adjudicated? [Water Code §10910(f)(2)]

The Tijuana Groundwater Basin is not one of the twenty-two (22) adjudicated groundwater basins within the State of California.

4.4.3 Is there a State of Overdraft? [Water Code §10910(f)(2)]

The South Coast Hydrologic Region is not listed as an aquifer or basin that is in a state of overdraft. Below are the details for the region as described in the DWR Groundwater Bulletin 160 (DWR, 1998).

California Hydrologic Regions – Overdraft Assessment

In an average year, about 30 percent of California's urban and agricultural applied water is provided by groundwater extraction. In drought years when surface supplies are reduced, groundwater supports an even larger percentage of use. The amount of water stored in California's aquifers is far greater than that stored in the State's surface water reservoirs, although only a portion of California's groundwater resources can be economically and practically extracted for use.

In wet years, recharge into developed groundwater basins tends to exceed extractions. Conversely, in dry years, groundwater basin recharge tends to be less than groundwater basin extraction. By definition, overdraft is not a measure of these annual fluctuations in groundwater storage volume. Instead, overdraft is a measure of the long-term trend associated with these annual fluctuations. The period of record used to evaluate overdraft must be long enough to produce data that, when averaged, approximate the long-term average hydrologic conditions for the basin. Table 5 (Table ES3-2 in DWR Bulletin 160-98) shows the Department's estimates of 1995 and 2020-level groundwater overdraft by hydrologic region. Within some regions, overdraft occurs in some well defined subareas, while additional groundwater development potential may exist in other subareas.

Table 5 (as appears as Table ES3-2 in DWR Bulletin 160-98)
1995 and 2020 Level Overdraft in Hydrologic Region (taf)

	1995		2020	
Region	Average	Drought	Average	Drought
North Coast	0	0	0	0
San Francisco Bay	0	0	0	0
Central Coast	214	214	102	102
South Coast	0	0	0	0
Sacramento River	33	33	85	85
San Joaquin River	239	239	63	63
Tulare Lake	820	820	670	670
North Lahontan	0	0	0	0
South Lahontan	89	89	89	89
Colorado River	69	69	61	61
Total (rounded)	1,460	1,460	1,070	1,070

Tijuana River Valley Watershed/Groundwater Basin – Overdraft Assessment

There has been a great deal of research performed on the Tijuana Groundwater Basin to determine the state of the groundwater within the area as a whole. Based on the most current studies found, as well as our own analysis of the area, it appears that there is annual groundwater recharge that is nearly 2 to 3 times larger than the amount being pumped. Below, for the remainder of Paragraph 4.4.3, is the detailed information excerpted directly from the Hydrogeological Assessment of the Tijuana River Valley (Rempel, 1992).

Geography

The Tijuana River hydrologic subarea in southern San Diego County includes approximately 7,000 acres extending from the Mexican Border to the Pacific Ocean. The alluvial aquifer underlying the Tijuana River Valley occupies an area of about 5,000 acres to depths of 100 feet or more. This hydrologic subarea lies at the downstream end of a 1,700 square mile watershed, of which about 30 percent lies in the United States and 70 percent in Mexico.

Rainfall

The average annual rainfall across the watershed ranges from about 11 inches near the coast to 25 inches at the higher inland elevations (Izbicki, 1985). Thus an average rainfall year represents a potential recharge of up to 4,500 acre-ft in the 5,000 acre alluvial aquifer. The average annual pan evaporation for the City of Chula Vista is about 64 inches (Zedler and Norby, 1986). Most rainfall usually occurs during the months of December through March when evapotranspiration is at a minimum. Considerable variability in rainfall patterns between extremely wet and very dry years is evident in records for the City of San Diego dating back to 1800.

Surface Water Hydrology

Intermittent flood flows are highly variable and are dependent upon rainfall amounts and intensity across the watershed. Brief periods of very high flows, primarily during the rainy season (December through March), are often followed by low (or no) summer flows. During periods of ground water overdraft, surface waters will provide recharge to the aquifer in direct proportion to the available storage. However, when the aquifer is full or overflowing, ground water seepage into the lower Tijuana River will create "gaining" stream conditions. Such conditions are apparent when ponds and stream flows in the valley are maintained in the absence of surface water input from Mexico.

Intermittent flood flow volumes also depend in part upon the operation of water supply reservoirs upstream which together control about 75% of the watershed. There are three such dams in the Tijuana River watershed. The two which lie farthest upstream (Barrett and Morena) are within the United States. The third (Rodriquez) is located south of Tijuana, Baja California, Mexico. The dams were all constructed prior to 1936 and are operated primarily for water supply rather than flood control.

According to US 'Geological Survey (Izbicki, 1985), the average annual discharge in the Tijuana River at the International Boundary from 1936 through 1981 was about 33,000 acre-ft/yr, compared to a "median" discharge of 659 acre-ft/yr. The maximum annual discharge was recorded during the 1979-80 water year when 586,000 acre-ft flowed through the lower Tijuana River Valley (Izbicki, 1985).

Groundwater Hydrology

The alluvial aquifer of the Tijuana River Valley is recharged primarily by direct rainfall, subsurface inflow from adjacent areas, and intermittent flood flows (Department of Water Resources, 1967). Rainfall and flood flows were discussed previously. The amount of ground water inflow from across the International Border has been estimated as 1,580 acre-ft/yr (Department of Public Works, 1952); 1,208 acre-ft/yr (OS Army Corps of Engineers, 1965); and 1,160 acre-ft/yr (International Boundary and Water commission, 1976). There is also potential recharge from water bearing zones east of Interstate 5 which has not been estimated.

The chief factors contributing to reduction of ground water in storage are agricultural pumping and evapotranspiration from phreatophytes. Ellis and Lee (1919) noted the possibility of minor outflow from the basin toward the north during periods of high ground water. The amount of ground water outflow along the ocean/freshwater interface is not known.

It is only when the amount of ground water removed from a basin chronically exceeds natural recharge from rainfall, subsurface inflow, and intermittent flood flows that the ground water table will begin to trend downward. The record for the lower Tijuana River Valley from 1965-1978 shows that once the rate of ground water extractions are reduced, ground water levels will recover even during an extended period of drier than normal rainfall and less than normal runoff (1965-1978).

Safe Yield

The best practical approach for determining whether or not future ground water level declines are likely, given the current rate of consumption, is to determine the hydrologic balance between total annual recharge and total annual losses. As an estimate of the average replenishment, the "safe yield" represents the rate at which ground water can be withdrawn from an aquifer without causing a long-term water table decline (Bouwer, 1978).

Published estimates of safe yield in the Tijuana River hydrologic subarea range from 5,500-6,000 acre-ft/yr (International Boundary and Water Commission, 1976) to 7,900 acre-ft/yr (Ellis and Lee, 1919). The Department of Water Resources (1975a) reported a natural recharge rate of 8,000 acre-ft/yr. Although one can expect seasonal fluctuations, as long as the total amount of ground water removed stays within or below this range of "safe yield", there will be no adverse effects on-ground water levels in the study area. It should be noted these published estimates of "safe yield" do not include any contribution from untreated sewage flows.

Groundwater Levels

The effects of sustained pumping at rates twice the average annual natural recharge are readily apparent in hydrographs of wells published by the Department of Public Works (1952) and in the all-time low water levels measured in the early 1960's (Department of Water Resources, 1967). Assuming uniform distribution of drawdown over the 5,000 acre alluvial aquifer and an average specific yield of 0.2 (Izbicki, 1985), the 1950-1953 overdraft of 23,000-30,500 acre-ft could result in a ground water decline of 23-30 feet or more. Thus, it is not surprising that by the early 1960's, ground water table elevations across much of the valley had fallen below sea level.

Due to this lowering of the ground water table, highly saline ground water from underlying and adjacent marine sediments and sea water began to invade and to degrade the alluvial aquifer (Department of Water Resources, 1975b). This salt water degradation, which became apparent in the 1960'S, contributed further to the overall declining demand for ground water discussed above. As consumption eventually became less than natural recharge, the resulting annual surplus of supply began to overcome years of accumulated deficits. It is, therefore, not surprising that water levels began recovering as early as the mid-1960's following the all-time lows of the early 1960's.

Significant reductions in the amount of ground water needed for irrigation (due to the factors discussed above) allowed the aquifer to recover about 15 feet in the vicinity of Hollister Bridge and at least 36 feet near the International Border during the period from February 1963 through April 1969 (Ocean Science and Engineering, 1971). Although there were intermittent periods of increased rainfall and associated flood flows in the 1965-66, 1966-67, and 196B-69 water years, the extended dry period which began in the mid-1940's, continued until 1978 (San Diego County Water Authority, 1990).

The years 1978-1980 brought nearly 48 inches of rain to the city of San Diego and resulted in flood flows in the Tijuana River. The wet winter of 1982-83, filled the aquifer to capacity and turned the usually

intermittent Tijuana River into a series of interconnected ponds. Water levels in the ponds were maintained throughout the summer by ground-water inflow (Izbicki, 1985).

Conclusions

At present, average ground water losses (estimated extractions and estimated evapotranspiration) are less than 1/2 to 1/3 published estimates of annual natural recharge, which does not include any contribution from untreated sewage flows. Thus, any seasonal drawdown of ground water levels during summer and fall will be more than compensated for during a typical rainy season (December-March) and by subsurface inflow from neighboring water bearing sediments.

4.4.4 Groundwater Pumped from the Basin during the Past Five Years [Water Code §10910(f)(3)]

No information pertaining to the wells is specified with the Department of Health Services regarding the amount of water pumped over the last five years. Anecdotal evidence from the owner indicates that historically, approximately 20 to 28 afy has been pulled from the well.

4.4.5 Projected Groundwater to be Pumped from the Basin by the Water Supplier [Water Code §10910(f)(3)]

As described above, it is estimated that the water suppliers other demands will increase by approximately 5 afy every five years. Allowing for this projected increased demand, the supply exceeds all demands from other users and from the proposed project (see Table 4 above).

4.4.6 Groundwater Source – Summary

The private well near Pine Valley is approximately 200 feet deep; at this depth, it may be pulling from either the onsite upper alluvial aquifer, or fractured bedrock formation further below. The water in these formations supplies Barrett Lake (as well as any water formations that underlie Barrett Lake), which is a recharge source for the Tijuana Groundwater Basin. Therefore the DWR designated Groundwater Basin that is ultimately affected by pumping water from the site is the Tijuana Groundwater Basin. Based on the review of available data and documentation, existing pumping from the alluvial aquifer located within the affected groundwater basin (Tijuana Groundwater Basin) is estimated at 1,500 afy, while the safe yield from the aquifer may actually be as high as 5,500 afy to 7,900 afy. Natural recharge may be as high as 8,000 afy. For this reason the aquifer is not considered to be in a state of overdraft and thus there is no need for a program to mitigate overdraft.

The long term demand for the proposed project to be supplied by this well, as shown in Table 4, is 0.18 afy for toilet flushing, with one-time demands of 50 af for construction and 0.03 af for fire suppression at the beginning of the project. This demand is nominal when compared to the existing pumping demands, potential safe yield, and the recharge rate of either the alluvial aquifer alone, or the alluvial aquifer.

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Appendix 1

Determination of Nonconforming Use Letter

Private Well Near Pine Valley, California

3-3-03

GARY PRYOR
DIRECTOR
(619) 694-2962

County of San Diego

DEPARTMENT OF PLANNING AND LAND USE
6201 Ruffin Road, Suite B, San Diego, California 92123-1666
Information (619) 694-2960

San Marcos Office
338 Via Vera Cruz - Suite 201
San Marcos, Ca 92069-2670
(760) 471-0730

El Cajon Office
200 East Main St - Sixth Floor
El Cajon, Ca. 92020-3912
(619) 441-4030

March 3, 2003

Water Rights

Mr. Alfred E. Martin
24019 Japatul Valley Rd.
Alpine, CA. 91901

Subject: Determination of Nonconforming Use for A Water Distribution Business on property Known as Assessor Parcel Number 406-251-06-00.

Dear Mr. Martin:

Based on the information you submitted, the Department of Planning and Land Use has determined that the Groundwater Distribution Business,(the selling or giving of water) located at 0000 Japatul Valley Rd. Assessor Parcel Number 406-251-06-00, can be considered legal nonconforming and therefore subject to the Nonconformity Regulations of the San Diego County Zoning Ordinance Section 6852. Existing Groundwater Extraction Operations as described in San Diego County Zoning Ordinance section 6864 may occur.

Please see enclosed Ordinance.

The Water Distribution Business consists of the following:

1. One legal water well and storage tank, with access off of Japatul Valley Rd.

Please retain a copy of this letter, as it will be the only evidence of this determination.

If you have any further questions regarding this matter, please contact me at (619) 441-4083.

Sincerely

Van L Ford
Code Enforcement Officer

"Prevention Comes First"

Appendix 2

Summary of Local Management Plan for Tijuana River Watershed

Source: San Diego County Water Authority, Integrated Regional Water Management Plan, 2007

Tijuana HU (911)	PLAN: Tijuana WMP	LEAD GROUP: 'SDSU Dept of Geography; Binational Watershed Advisory Council	2005
OVERVIEW: The Tijuana River watershed vision provides a framework for harmonizing data and stakeholder inputs. A vision describes the past, present, and desired future conditions of a watershed. It is interdisciplinary and combines data from scientists, social scientists, practitioners, and watershed stakeholders. The visioning process encourages stakeholder participation, and has been shown to be a successful way of creating realistic and sustainable watershed management plans (Montgomery and Sullivan 1995).			
DESCRIPTION: The Tijuana River Watershed (TRW) lies across the U.S.-Mexican international boundary and is approximately 1,750 square mile (4,465 square km) in area, with one-third in California and two-thirds in Baja California. The watershed is a place of natural and cultural beauty that is at risk from uncontrolled urbanization and infrastructure deficits. Growing human populations and land use changes have brought numerous environmental problems to the TRW region. These include: Decline in local groundwater quantity and further dependence on imported water; Decline in quality of surface and groundwater for human use; Increased erosion and flood dangers; Increased air pollution; Reduction in the amount of safe, open, and green areas for urban residents; Decline in ecosystem health; Increasing number of threatened and endangered plants and animals. In 2002 a binational team of researchers and practitioners, the Binational Watershed Advisory Council (BWAC), was convened to address these environmental challenges. The council identified stakeholders in the watershed who, in turn, participated in the development of this Binational Vision for the TRW, a snapshot of the current and desired conditions in the TRW. The stakeholders also helped to devise strategies and options for achieving that Vision. The Vision document contains baseline data and trends for the major areas of concern identified by stakeholders: water, air, ecosystems and natural resources, waste, and socioeconomic issues.			
PRIORITIES OR GOALS: The stakeholders of the Tijuana River Watershed desire to meet the needs of the present while protecting resources for future generations; to create a balance between natural resource protection, economic development, and quality of life; to proactively manage local surface and groundwater for long-term sustainability; to protect, restore, and connect habitats; to create a strong economic base for sustainable development; and to create human communities that allow people to enjoy the unique cultural and natural landscapes and functions of the watershed.			

Source: SDCWA *Integrated Regional Water Management Plan, October,* 2007.

Appendix 3

Estimation of Supply and Demand for Private Well near Pine Valley

Water Supplier: Private Well Near Pine Valley

Estimation of Supply and Demand from Other Users:

1. Supply*

Well pump flow rate:	150	gpm
Potential operating period:	12	hours/day
Total volume:	108,000	gpd
	39,420,000	gpy
	121	afy

Assumptions:

*Restricted only by well pump equipment and potential operating period. Assumes no restrictions on owner's yield from aquifer, and based on verbal anecdotal evidence of potential pumping from well.

2. Demand by Other Users

High season use:	8100000	gallons (90,000 gpd for 3 months)**
Average use (not including high season):	1080000	gallons (90,000 gal each month on average)***
Total:	9180000	gallons
	28.17	afy

Assumptions:

**Highest usage of the well, recorded in 2010.

***In addition to the high season usage, assume an average of 90,000 gal/month in water sales, estimate only. Assumes seller sells volumes of tank 3 times per month (30,000 gal on site tank), based on verbal anecdotal evidence.

Information on well supply and demand data obtained from the owner through his water hauler via email and telephone exchanges in February 2011.

Appendix Q

Paleontological Survey Report

PALEO SOLUTIONS
Paleontological & Archaeological Compliance & Consulting Services
2035 Placentia Ave • Suite D • Costa Mesa • CA 92627

CONFIDENTIAL PALEONTOLOGICAL SURVEY REPORT: OCOTILLO WIND EXPRESS PROJECT

Prepared for:

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Prepared by:

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April 25, 2011

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1.0 EXECUTIVE SUMMARY

Pattern Energy, through Ocotillo Express LLC (OE LLC), proposes to construct, operate, maintain and decommission a 561 megawatt (MW) wind generation facility on approximately 15,028 acres in the Ocotillo Express Wind Project Area (see Figure 1), hereafter referred to as the Project area. Paleo Solutions was retained by Aspen Environmental Group in order to identify and analyze possible effects to paleontological resources resulting from the implementation of the proposed Ocotillo Wind Express Project (Aron and Kelly, 2010), and to complete a pre-construction paleontological field survey in order to reduce potential adverse impacts on scientifically important surface fossils resulting from construction to a less than significant level. This report synthesizes all the paleontological data collected in order to perform the paleontological resources analysis for the Ocotillo Express Wind EIS, and presents the results of the paleontological field survey.

The Project area is located on approximately 15,002 acres of Bureau of Land Management (BLM) managed lands, and includes an additional 26 acres of private land proposed for Project-related activities. The Project area is located in Imperial County, California, close to the intersection of Highways 8 and 98 and the town of Ocotillo, approximately one mile south of the Coyote Mountains, and five miles north of the international border.

Prior to the completion of the paleontological field survey for the Project, a pre-survey paleontological assessment was completed (Aron and Kelly, 2010). The assessment analyzed the paleontological potential of the Project area using reviews of published scientific literature, geologic maps and museum records, and involved consultation with professional paleontologists who are familiar with the area. Based on the data obtained for the assessment, the geologic units within the Project area were ranked using the Potential Fossil Yield Classification System (PFYC) (BLM IM 2008-009), and the rankings were approved by the BLM. The results of the paleontological assessment were used to delineate locations within the Project area that were surveyed.

The paleontological assessment (Aron and Kelly, 2010) recommended all areas mapped as undifferentiated plutonic crystalline basement rocks (PFYC Class 1) and Quaternary Alluvium and Quaternary Terrace Alluvium (PFYC Class 2) for immediate paleontological clearance because these units have little or no potential for producing in-situ fossils (see Figure 2). These units were estimated to comprise approximately 11,361 acres of the total Project area. Areas mapped as Alverson Canyon Formation, Latrania Formation (Imperial Group), Split Mountain Formation, Palm Spring Formation, and Older Alluvium, have a moderate or unknown (PFYC Class 3) to very high potential (PFYC Class 5) for producing scientifically important fossil remains, and were recommended for a 100% pre-construction pedestrian inventory focused on areas with good exposures (i.e. unvegetated and not covered by soil, slopewash, etc.). Based on the geologic map, these deposits comprise approximately 3,640 acres of the Project area (see Figure 3).

The paleontological field survey was completed over a total of 10 days between December 21, 2010, and January 6, 2011, by Paleo Solutions. All field work was completed under BLM paleontological resources use permit CA-10-00-006P. Fifty six quarter-quarter sections (2,240 acres, see Figure 4) that include exposed rocks of the Alverson Formation, Split Mountain

Formation, Latrania Formation, Palm Spring Formation, and Pleistocene older alluvium were surveyed. The survey was designed as a block inventory of all areas that could contain scientifically important surface fossils, so that adjustments to the locations of proposed Project facilities within the Project area will not result in the need for additional paleontological surveys.

The objective of the field survey was to document all scientifically significant surface fossils within the Project area. Thirty four fossil localities were documented during the field survey (see tables 3 and 4, and Figure 5). These include four localities in the Mio-Pliocene Latrania Formation consisting of fossil marine invertebrates, and 30 fossil localities in the Plio-Pleistocene Palm Spring Formation consisting of fossil vertebrates. Thirty one of the vertebrate and marine invertebrate fossil localities that were documented did not preserve scientifically significant fossils. Three fossil localities that preserved scientifically significant vertebrate fossils were initially documented and then collected following BLM consultation. These fossils include 16 specimens consisting of turtle carapace and plastron fragments and limb elements; camelid post-crania including a distal 1st phalanx of the extinct llama cf. *Hemiauchenia* sp., a lumbar vertebral centrum of the extinct camel cf. *Camelops* sp.; an undetermined artiodactyl astragalus, a lumbar vertebra (proximal portion of right transverse process) of an unidentified artiodactyl, and unidentified mammal bones collected from the Palm Spring Formation (written communication, G. Jefferson, ABDSP-DSRC, 2011). These fossils have been prepared, identified, and have been transferred to ABDSP-DSRC for permanent museum storage (Appendices C and D). Copies of BLM fossil locality forms are appended to this report (Appendix E). Occurrences of well-preserved fossil wood were found to be widespread throughout the Palm Spring Formation within the Project area, and as a result, none of these fossil localities were recorded, collected or recommended for avoidance. Deposits of Pleistocene older alluvium, although widespread, were found to be devoid of fossils, and it is recommended that these be downgraded to PFYC Class 2 within the Project area for future resource management purposes (although they were designated PFYC Class 3a at the time of this analysis).

With the completion of the field survey, all 30 fossil localities recorded in the Palm Spring Formation are recommended for avoidance by project-related surface disturbance because of the potential for impacting additional scientifically significant subsurface fossil remains. All of these localities are located in two larger areas of Palm Spring Formation that are recommended for avoidance by project-related surface disturbance because of the high density of fossil localities recorded in these areas during the field survey (see Figure 6). Based on the Project Proposed Action, these avoidance areas are currently not located within the area of potential effect, but it is recommended that they be avoided by future surface disturbing actions in order to preserve the fossils in their native geologic context for the benefit of future scientific research efforts. If avoidance of these areas is not feasible, then construction monitoring should be required. Four fossil localities located in the Latrania Formation (see Table 4) should be spot-check monitored during construction if they will be impacted. Based on the Project design plans, 63 acres of very high potential (PFYC Class 5) geologic units will be impacted by Project-related surface disturbance. These areas should be monitored for paleontological resources during construction (see Figure 7). Project construction is the only phase of Project operations that has the potential to results in direct adverse effects to subsurface fossils as the result of surface disturbance, although increased access to the area by the general public and Project personnel may result in greater indirect effects to surface fossils that erode onto the surface in the future. Prior to construction, all Project personnel involved with ground disturbing operations should

undergo training to be taught to recognize the presence of fossils in construction excavations. During construction and during future Project operations, the BLM Authorized Officer should be notified immediately if any fossils are encountered by construction or other Project personnel.

2.0 INTRODUCTION

Paleo Solutions was retained by Aspen Environmental Group in order to identify and analyze possible effects to paleontological resources resulting from the implementation of the proposed Ocotillo Wind Express Project. Pattern Energy, through Ocotillo Express LLC (OE LLC), proposed to construct, operate, maintain and decommission this 561 megawatt (MW) wind generation facility on approximately 15,002 acres in the Ocotillo Express Wind Project Area (figures 1 and 2). The Project area is located on approximately 15,002 acres of BLM managed lands, and includes an additional 26 acres of private land proposed for Project-related components However, since the Project was initially proposed, a reduction in scope of maximum buildout has occurred. This report reflects the original data from the BLM and Pattern Energy.

Paleontological resources, or fossils, are the remains of extinct organisms, and provide the only direct evidence of ancient life. They are considered to be non-renewable resources because they cannot be replaced once they are destroyed. The Federal Land Policy and Management Act of 1976 (FLPMA) mandates the treatment of paleontological resources as a scientific value (FLPMA section 102[8]). For the purpose of this analysis, and in accordance with existing BLM policy (BLM H-8270-1; BLM IM 2009-011), scientifically significant paleontological resources are defined as vertebrate fossils that are identifiable to taxon and/or element, noteworthy occurrences of invertebrate and plant fossils, and vertebrate trackways. In general, surface disturbing actions have the potential to cause adverse effects on surface and subsurface paleontological resources in rock units and overlying sediments known to contain them. Direct effects include destruction due to breakage and fragmentation. Indirect effects may result from increased accessibility to paleontological resources resulting in an increased likelihood of vandalism or unauthorized collection. In paleontologically sensitive areas, the objective of paleontological mitigation is to reduce adverse effects on paleontological resources to a less than significant level by recovering fossils and associated contextual data prior to and during ground disturbing activities. Paleontological mitigation results in a beneficial impact when scientifically important fossils and associated data are housed in perpetuity and made available for educational purposes and scientific research in an accredited and federally approved museum.

This report presents the results of the paleontological field survey completed for the Ocotillo Wind Express Project, and synthesizes the pre-survey data analysis. Prior to the completion of the paleontological field survey for the Project, a pre-survey paleontological assessment was completed (Aron and Kelly, 2010). The assessment analyzed the paleontological potential of the Project area using reviews of published scientific literature, geologic maps and museum records, and involved consultation with professional paleontologists who are familiar with the area.

Based on the results of the pre-survey paleontological assessment (Aron and Kelly, 2010), the field survey was focused on approximately 3,640 acres of Alverson Canyon Formation, Latrania Formation (Imperial Group), Split Mountain Formation, Palm Spring Formation, and Older Alluvium. Areas containing undifferentiated plutonic crystalline basement rocks, Quaternary Alluvium, and Quaternary Terrace Alluvium comprised approximately 11,361 acres of the Project area, and were not surveyed because they have little potential to produce fossil remains.

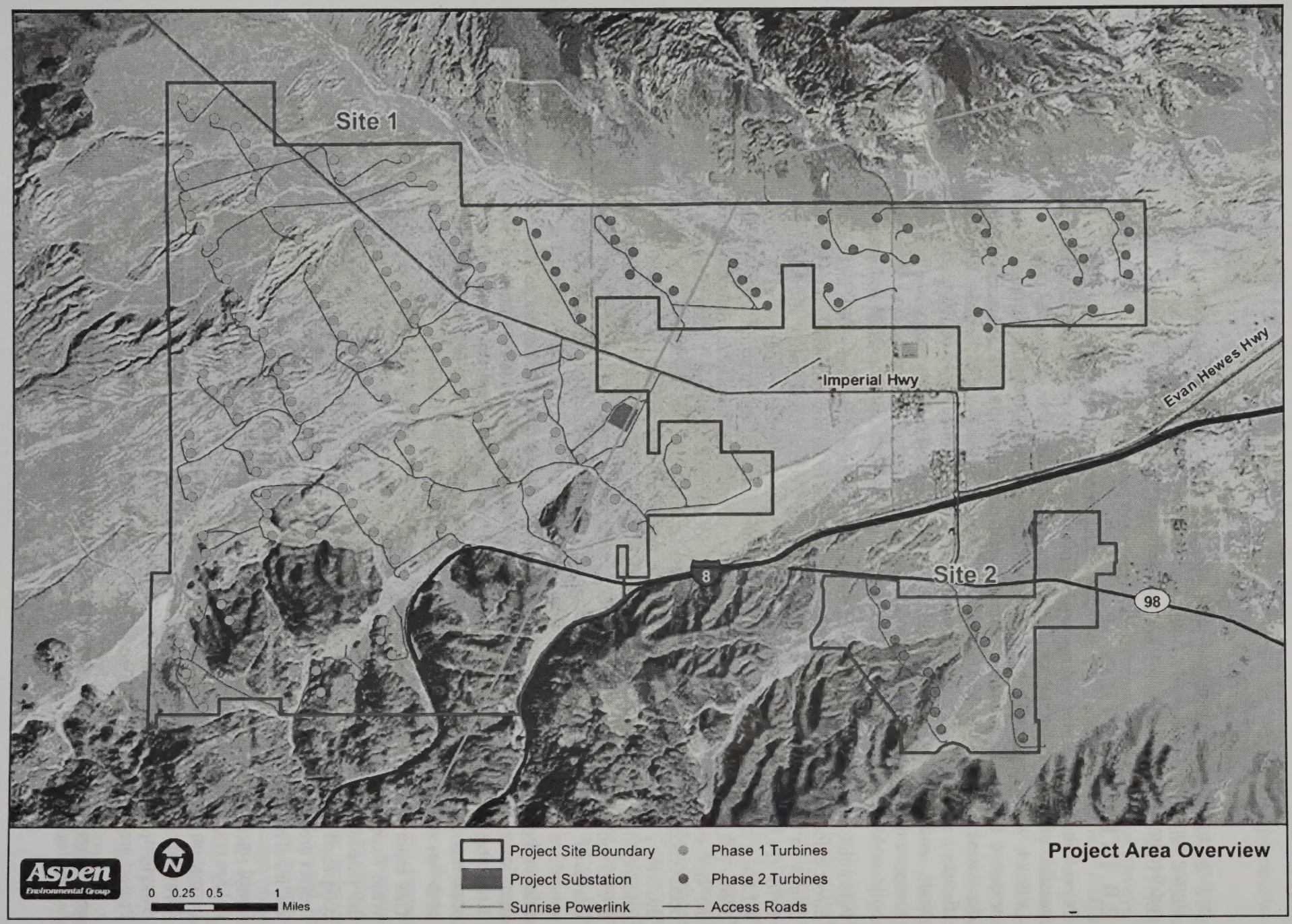

Figure 1. Map showing the boundaries and location of the Ocotillo Wind Express Project in Imperial County, California.

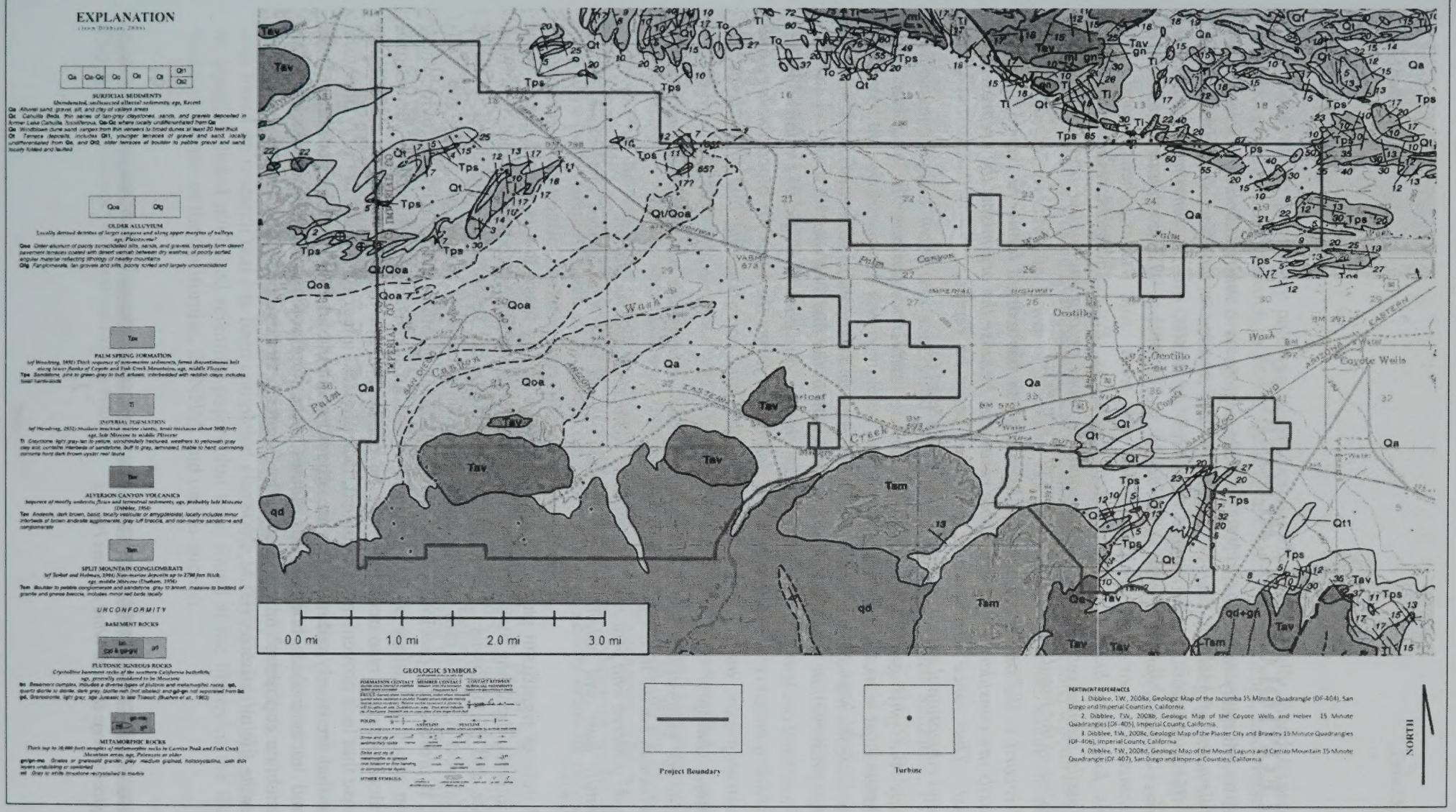

Figure 2. Geologic map of the Ocotillo Wind Express Project area (qd, Mesozoic and older crystalline basement rocks; Tsm, Split Mountain Formation; Tav, Alverson Formation; Ti, Latrania Formation of Imperial Group; Tps, Palm Spring Formation; Qoa, older alluvium; Qt, terrace deposits; Qa, alluvium (adapted from Dibblee (2008a-d).

3.0 PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch (2007): *"Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils' associated sedimentary matrix.*

The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. Fossils are important scientific and educational resources because they are used to:

- *Study the phylogenetic relationships among extinct organisms, as well as their relationships to modern groups.*
- *Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record.*
- *Reconstruct ancient environments, climate change, and paleoecological relationships.*
- *Provide a measure of relative geologic dating that forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for isotopic dating.*
- *Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time.*
- *Study patterns and processes of evolution, extinction, and speciation.*
- *Identify past and potential future human-caused effects to global environments and climates."*

The BLM defines significant paleontological resources as any fossil that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be of scientific interest if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity because of decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities (BLM, 2008).

4.0 Methods

The scope of the pre-survey paleontological analysis for the Ocotillo Wind Express Project included geologic map research, a review of relevant scientific literature, and museum record searches. The pre-survey data were presented in a paleontological assessment report (Aron and Kelly, 2010). This report synthesizes the pre-survey data with the field survey results. It was conducted in accordance with current BLM paleontological resource management policy (BLM Manual and Handbook 8270-1, 1998; BLM IM 2008-009, 2007; BLM IM 2009-011, 2008).

4.1 Project Location

The Project area is located in Imperial County, California, close to the intersection of Interstate 8 and Highway 98 and the town of Ocotillo, approximately one mile south of the Coyote Mountains, and five miles north of the international border (figures 1 and 2).

4.2 Personnel

All paleontological work was supervised by Geraldine Aron of Paleo Solutions, PI on BLM Paleontological Resources Use Permit CA-10-00-006P. Jennifer Kelly of Paleo Solutions requested the records search and completed the literature search. The field work was completed by Geraldine Aron, Scott Armstrong, Maria Espinoza, Jeff Hathaway, and Mark Deering. The GIS analysis and map preparation was completed by Mark Deering. This report was prepared by Geraldine Aron and Jennifer Kelly.

4.3 Records Searches

The purpose of the record searches was to determine whether any museum fossil localities occur within or adjacent to the Project area, and ascertain the abundance and taxonomic diversity of fossils collected from the same geologic formations elsewhere in this part of the Imperial Valley to assist with the estimation of paleontological potential of the Project area. This was necessary because, to the best of our knowledge, no prior paleontological inventories within the Project area have been completed, although paleontological surveys of nearby areas by paleontological researchers at area museums have taken place over the years.

Paleontological record searches for this Project were requested by Paleo Solutions and were completed by curatorial staff at the San Diego Natural History Museum (SDNHM), Anza-Borrego Desert State Park (ABDSP-DSRC), and the Natural History Museum of Los Angeles County (LACM). Copies of the record search results are appended to this report (Appendix A), and the results are summarized in Section 7.0 of this report.

4.4 Literature Searches

The purpose of the literature searches was, like the records searches, to determine whether any previously recorded fossil localities occur within the Project area and to research the paleontological potential, stratigraphy, and general geology of the formations within the Project area based on research that has been completed elsewhere in the Imperial Valley. The literature reviewed included published scientific papers that were found at the library of the Biodiversity Research Center of the Californias, SDNHM, and on the internet.

4.5 Geologic Map Review

The purpose of the geologic map reviews was to determine the names and number of geologic formations and surficial deposits within the Project area and their geographic distribution. The geologic maps reviewed for this analysis include the following: Dibblee (2008a-d), Morton (1977), and Todd and Alvarez (2004). The geologic mapping of Dibblee (2008a-d) was used to create a PFYC map (see Section 9.0).

4.5 Field Survey

The objective of the field survey was to document all scientifically important surface fossils within the Project area. The field survey took place between December 21, 2010, and January 6, 2011. Fifty six quarter-quarter sections (2,240 acres) that include exposed rocks of the Alverson Formation, Split Mountain Formation, Latrania Formation, Palm Spring Formation, and Pleistocene older alluvium were surveyed. The survey was designed as a block inventory of all areas that could contain scientifically important surface fossils, so that adjustments to the locations of proposed Project facilities within the Project area will not result in the need for additional paleontological surveys.

The field survey protocol consisted of a pedestrian examination of all potentially fossil-bearing but safely accessible exposures and outcrops Non-potentially fossil-bearing areas and inaccessible areas were visually surveyed (non-pedestrian). Visual surveys were done in areas where it was determined a pedestrian survey was not necessary due to factors such as the obscuring of bedrock by vegetation, slope wash, or colluvium, or in areas where the ground was unstable or inaccessible. All fossil localities were recorded using a Trimble GPS receiver (NAD 83 datum). All fossil localities were photographed, as well as the best-preserved and potentially diagnostic fossils. Occurrences of fossil wood including occasional fossil logs are widespread throughout the Project area in the Palm Spring Formation. Therefore, these were not recorded, and their locations are not included in this report.

The BLM requested that no fossils documented during the field survey be collected without prior authorization. Upon completion of the field survey, Paleo Solutions recommended to the BLM that the most scientifically significant fossils be collected. Not all of these fossils were re-located due to their small size. The fossils that were collected were then cleaned and prepared as appropriate, and transferred to the ABDSP-DSRC in January, 2011, for curation where they will be permanently available for future scientific inquiry. The findings of the field survey are compiled in this report, along with paleontological mitigation recommendations as appropriate.

5.0 Regulatory Requirements

This section of the report presents the regulatory requirements that are applicable to the Ocotillo Wind Express Project.

5.1 Federal Laws and Regulations

The management and preservation of paleontological resources on public lands are governed under various laws, regulations, and standards. For the past several decades, the BLM has used the Federal Land Management and Policy Act (FLPMA, 1976) as the legislative foundation for its paleontological resource management policies. The BLM has also developed general

procedural guidelines (Manual H-8720-1; Instructional Memorandum [IM] 2008-009; IM 2009-011) for the management of paleontological resources (BLM, 2007, 2008). Paleontological resource management objectives include the evaluation, management, protection and location of fossils on BLM managed lands. Management policy also includes measures to ensure that proposed land-use projects do not inadvertently damage or destroy scientifically significant paleontological resources. This technical assessment report was prepared to evaluate the potential for project-related impacts on scientifically significant fossils within the Project area, and includes mitigation recommendations.

The National Environmental Policy Act of 1969, as amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258 § 4(b), Sept. 13, 1982). Recognizes the continuing responsibility of the Federal Government to "preserve important historic, cultural, and natural aspects of our national heritage . . ." (Sec. 101 [42 USC § 4321]) (#382).

Federal Land Management and Policy Act of 1976 (43 U.S.C. 1712[c], 1732[b]); sec. 2, Federal Land Management and Policy Act of 1962 [30 U.S.C. 611]; Subpart 3631.0 et seq.), Federal Register Vol. 47, No. 159, 1982. Defines significant fossils as: unique, rare or particularly well-preserved; an unusual assemblage of common fossils; being of high scientific interest; or providing important new data concerning [1] evolutionary trends, [2] development of biological communities, [3] interaction between or among organisms, [4] unusual or spectacular circumstances in the history of life, [5] or anatomical structure.

Paleontological Resources Preservation, Omnibus Public Lands Act, Public Law 111-011, Title VI, Subtitle D (OPLA-PRP, 2009). This legislation directs the Secretaries (Interior and Agriculture) to manage and protect paleontological resources on federal land using "scientific principles and expertise." OPLA-PRP incorporates most of the recommendations of the report of the Secretary of the Interior entitled Assessment of Fossil Management on Federal and Indian Lands (2000) in order to formulate a consistent paleontological resources management framework. In passing the OPLA-PRP, Congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. The OPLA-PRP codifies existing policies of the BLM, National Park Service, U.S. Forest Service, Bureau of Reclamation, and U.S. Fish and Wildlife Service, and provides the following:

- *Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossils from federal lands*
- *Uniform minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants)*
- *Uniform definitions for "paleontological resources" and "casual collecting"*
- *Uniform requirements for curation of federal fossils in approved repositories*

Federal legislative protections for scientifically significant fossils applies to projects that take place on federal lands (with certain exceptions such as DOD), involve federal funding, require a federal permit, or involve crossing state lines. Because the vast majority of the proposed Project area occurs on BLM managed lands, federal protections for paleontological resources apply under NEPA, FLPMA, and OPLA-PRP.

5.2 State and Local Regulations and Laws

The procedures, types of activities, persons, and public agencies required to comply with CEQA are defined in: Guidelines for the Implementation of CEQA, as amended March 29, 1999 (Title 14, Chapter 3, California Code of Regulations: 15000 et seq.). One of the questions listed in the CEQA Environmental Checklist (Section 15023, Appendix G, Section XIV, Part A) is: "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?"

The State of California Public Resources Code (Chapter 1.7), Section 5097.5 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes requires reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, define the removal of paleontological "sites" or "features" from state lands as a misdemeanor, and prohibit the removal of any paleontological "site" or "feature" from state land without permission of the applicable jurisdictional agency. These protections apply only to State of California land, and thus apply only to portions of the proposed Project, if any, that occur on state land.

No other state or local laws and regulations are believed to be applicable to the proposed Project.

6.0 Permits and Approvals

This report was prepared under BLM Paleontological Resources Use Permit # CA-10-00-006P (expiration 4/20/2013). All paleontological work on BLM land must be approved and coordinated by the BLM El Centro Field Office. All fossils collected from BLM land must be housed in a federally approved paleontological repository. The survey was conducted under Fieldwork Authorizatio Number 8151(CA930)P. The paleontological repository for the above listed permit number is the SDNHM, and fossils collected during the survey were accessioned to the Anza Borrego Stout Research Center (See Appendix D) The Stout Research Center was recommended by the San Diego Natural History Museum as the repository for the fossils collected during the field survey, due to its proximity to the field area, as well as their larger collection of fossils from the Palm Spring and Latrania Formations.

7.0 Resource Assessment Criteria

This analysis utilizes the BLM's Potential Fossil Yield Classification System (PFYC). The PFYC follows, and is excerpted directly from BLM IM 2008-009 (2007).

Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources. However, it is impossible to predict the specific types of fossils that will be found or their exact locations in a geologic formation.

Using the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mappable level. It is not intended to be applied to specific paleontological localities or

small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions.

The descriptions for the classes below are written to serve as guidelines rather than as strict definitions. Knowledge of the geology and the paleontological potential for individual units or preservational conditions should be considered when determining the appropriate class assignment. Assignments are best made by collaboration between land managers and knowledgeable researchers.

Class 1 – **Very Low**. Geologic units that are not likely to contain recognizable fossil remains.

•Units that are igneous or metamorphic, excluding reworked volcanic ash units.

•Units that are Precambrian in age or older.

(1) Management concern for paleontological resources in Class 1 units is usually negligible or not applicable. (2) Assessment or mitigation is usually unnecessary except in very rare or isolated circumstances.

The probability for impacting any fossils is negligible. Assessment or mitigation of paleontological resources is usually unnecessary. The occurrence of significant fossils is non-existent or extremely rare.

Class 2 – **Low**. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

•Vertebrate or significant invertebrate or plant fossils not present or very rare.

•Units that are generally younger than 10,000 years before present.

•Recent aeolian deposits.

•Sediments that exhibit significant physical and chemical changes (i.e., diagenetic

alteration).

(1) Management concern for paleontological resources is generally low. (2) Assessment or mitigation is usually unnecessary except in rare or isolated circumstances.

The probability for impacting vertebrate fossils or scientifically significant invertebrate or plant fossils is low. Assessment or mitigation of paleontological resources is not likely to be necessary. Localities containing important resources may exist, but would be rare and would not influence the classification. These important localities would be managed on a case-by-case basis.

Class 3 – **Moderate** or **Unknown**. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

•Often marine in origin with sporadic known occurrences of vertebrate fossils.

•Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low. (or)

•Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.

Class 3a – **Moderate Potential.** Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil locality is low, but is somewhat higher for common fossils.

Class 3b – **Unknown Potential.** Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

(1) Management concern for paleontological resources is moderate; or cannot be determined from existing data. (2) Surface-disturbing activities may require field assessment to determine appropriate course of action.

This classification includes a broad range of paleontological potential. It includes geologic units of unknown potential, as well as units of moderate or infrequent occurrence of significant fossils. Management considerations cover a broad range of options as well, and could include pre-disturbance surveys, monitoring, or avoidance. Surface-disturbing activities will require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action, and whether the action could affect the paleontological resources. These units may contain areas that would be appropriate to designate as hobby collection areas due to the higher occurrence of common fossils and a lower concern about affecting significant paleontological resources.

Class 4 – **High**. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface disturbing activities may adversely affect paleontological resources in many cases.

Class 4a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two acres. Paleontological resources may be susceptible to adverse impacts from surface disturbing actions. Illegal collecting activities may impact some areas.

Class 4b – These are areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a

protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

•Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.

•Areas of exposed outcrop are smaller than two contiguous acres.

•Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.

•Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 4 is moderate to high, depending on the proposed action. (2) A field survey by a qualified paleontologist is often needed to assess local conditions. (3) Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered. (4) Class 4 and Class 5 units may be combined as Class 5 for broad applications, such as planning efforts or preliminary assessments, when geologic mapping at an appropriate scale is not available. Resource assessment, mitigation, and other management considerations are similar at this level of analysis, and impacts and alternatives can be addressed at a level appropriate to the application.

The probability for impacting significant paleontological resources is moderate to high, and is dependent on the proposed action. Mitigation considerations must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities.

Class 5 – **Very High**. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation.

Class 5a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities.

Class 5b – These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

• Extensive soil or vegetative cover; bedrock exposures are limited or not expected to

be impacted.

•Areas of exposed outcrop are smaller than two contiguous acres.

•Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.

•Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 5 areas is high to very high. (2) A field survey by a qualified paleontologist is usually necessary prior to surface disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions. (3) Official designation of areas of avoidance, special interest, and concern may be appropriate.

The probability for impacting significant fossils is high. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys prior to authorizing any surface disturbing activities will usually be necessary. On-site monitoring may be necessary during construction activities.

8.0 Literature and Geologic Map Reviews

Multiple published geologic maps that include the Project area were reviewed for this analysis (Dibblee, 2008a-d; Morton, 1977, Todd and Alvarez, 2004). For consistency of geologic unit nomenclature, we chose to utilize the geologic mapping of Dibblee (2008a-d) as our primary source. According to these workers, seven sedimentary geologic units (groups, formations, members, and informally named surficial deposits) occur within the Project area. Bedrock units include the middle Miocene Split Mountain Formation, middle Miocene Alverson Canyon Formation, the late Miocene and Pliocene Latrania Formation of the Imperial Group, and the Plio-Pleistocene Palm Spring Formation. These units are mostly mantled by surficial deposits of Quaternary (Pleistocene) Older Alluvium, Quaternary Alluvium, and Quaternary Terrace Alluvium. The geographic distribution of the geologic units within the Project area is illustrated in Figure 2.

No specific reports of fossil localities within the boundaries of the Project area were found in the literature reviewed for this analysis. However, numerous fossils have been described in the literature from the same geologic units at other locations in the Imperial Valley. The following subsections summarize the general geology, stratigraphy, and paleontological resources of the sedimentary geologic units that are present within the Project area.

8.1 Regional Geologic Setting

During the early Miocene, the evolution of the San Andreas Fault and East Pacific rise created a spreading zone between the North American and Pacific Plates (Crowell, 1974b). This change in the boundary orientation caused a graben to form between the plates (Singer 2005). The subsidence of the resulting fault-bounded basin combined with a global oceanic highstand caused much of the Imperial Valley to be inundated, forming an inland sea (Dorsey, 2006).

Simultaneous uplift and erosion of proximal regions provided nearby sediment sources (Crowell 1974a). This created an environment in which a massive influx of sediment was deposited unconformably on top of Cretaceous and older crystalline and metasedimentary basement rocks. Crustal thinning during the Miocene in this region also created conditions suitable for rift volcanism and igneous intrusion into sedimentary strata (Crowell, 1974a).

Miocene age sediments in the Imperial Valley consist of progradational and retrogradational sequences of conglomerate, sandstone, and siltstone on wave-cut terraces (Deméré, 2006). The

Split Mountain Formation suggests a period of deposition by large debris flows and high energy braided rivers associated with a period of rapid uplift of nearby terrain and large scale rifting (Dorsey, 2006). The abrupt facies change between Split Mountain megabreccia conglomerates and the well-sorted sandstone beds of the Latrania Formation record the relatively rapid transition from nonmarine to marine deposition (Dorsey, 2006).

During the last one to two million years, modern strike slip faulting initiated widespread regional uplift that elevated and eroded older marine sediments (Dorsey, 2006). The gradual buildup of the Colorado River delta during the Pliocene formed a natural levee that enclosed the basin from marine intrusion and created an enclosed lake basin (Alles, 2007). Modern erosion continues to fill the basin with young alluvial sediments (Dorsey, 2006).

8.2 Mesozoic Crystalline Basement Rocks

According to Dibblee (2008a-d), one intrusive igneous rock unit occurs within the Project area. It consists of undifferentiated plutonic crystalline basement rocks including late Triassic to Jurassic dark gray biotite rich quartz diorite to diorite. Intrusive igneous rocks do not contain recognizable fossils because they are formed deep under the earth's surface at extremely high temperatures and pressures.

Based on this analysis, Mesozoic crystalline basement rocks within the Project are considered to have very low paleontological sensitivity (PFYC Class 1). Mesozoic crystalline basement rocks occur within much of the southern portion of the Project area (qd, Figure 2).

8.3 Split Mountain Formation

Tarbett and Holman (1944) named the Split Mountain Formation for a sequence of conglomerate, breccia, and sandy marine turbidite deposits that are exposed in Split Mountain Gorge (Dorsey, 2006; Woodard, 1974). Based on the conformable transition from terrestrial to marine strata, the upper, marine part of the Split Mountain Formation was reassigned to the lower Imperial Formation, and later renamed the Latrania Formation of the Imperial Group (Kerr and Kidwell, 1991; Remeika, 1998; Winker and Kidwell, 1996). In this revision, the Anza, Alverson and lower Split Mountain formations were assigned to the Split Mountain Group. The stratigraphy of the Split Mountain and lower Imperial groups is highly complex, with abrupt lateral facies, lithology, and thickness changes (Dorsey, 2006). For the purpose of this report, and for consistency with the stratigraphic nomenclature in the geologic maps utilized for this analysis, the original term Split Mountain Formation is followed here (Dibblee, 2008a).

Of middle Miocene age, the Split Mountain Formation is composed of granite- and gneiss-breccia, gray to brown, massive to bedded, boulder- to pebble-conglomerate and sandstone with localized minor red beds (Dibblee, 2008a). It was deposited on an erosional surface that was cut into Paleozoic and Cretaceous rocks (Dibblee, 2008a), in a rift basin as an alluvial fan of the Colorado River (Dorsey et al., 2007).

Due in large part to its depositional origins, the Split Mountain Formation contains few fossils, and no specific reports of fossils from this unit were found during the literature or museum record searches completed for this analysis. Because it is sparely fossiliferous, any new fossils discovered within the Split Mountain Formation would be of particular scientific importance. Based on this analysis, the Split Mountain Formation is considered to have unknown

paleontologic potential (PFYC Class 3b). Within the Project area, the Split Mountain Formation is limited to a small area of exposures located southwest of the town of Ocotillo (Tsm, Figure 2).

8.4 Alverson Canyon Formation

The middle Miocene Alverson Canyon Formation (also known as the Alverson Formation, Alverson Canyon Volcanics, or Alverson Andesite), is an approximately 700 foot thick sequence of non-marine sandstone and conglomerate associated with volcanic flows named by Tarbet and Holman (1944) for rocks located in Fossil (Alverson) Canyon on the southeast flank of the Coyote Mountains. Lithologies include andesite flows of varied color with interbedded tuff, breccia, non-marine sandstone and conglomerate (Morton, 1977). The Alverson Formation overlies and interfingers with the Anza Formation of the Split Mountain Group or overlies crystalline basement rocks, and underlies the Pliocene Imperial Group (Dibblee 2008a-d, Morton, 1977; Todd and Alvarez, 2004). This formation has been radiometrically dated to approximately 16 million years old (Eberly and Stanley, 1978).

The volcanic facies of the Alverson Canyon Formation contains no recognizable fossil remains (PFYC Class 1). However, the sedimentary facies have produced the fossilized remains of algae, pollen, petrified wood, and mollusks, as well as unidentified vertebrate bone (Fourt, 1979). The SDNHM has recovered isolated teeth of heteromyid and sciurid rodents from a fine-grained sandstone bed in the Alverson Canyon Formation within one mile of the Project area (see Table 1) (Randall, 2010). Based on this analysis, the Alverson Canyon Formation has moderate paleontologic potential (PFYC Class 3a). The Alverson Canyon Formation is mapped as occurring in the southern portion of the Project area (Tav, Figure 2).

8.5 Latrania Formation (Imperial Group)

The upper Miocene to lower Pliocene (Deméré, 2006; Dibblee, 2008a-d) Imperial Formation was named by Woodring (1931), and is dominantly marine in origin (McDougall et al., 1999). The most recent (although informal) stratigraphic revision resulted in the elevation of the Imperial Formation to group status, consisting of a lower Latrania Formation and an upper Deguynos Formation. The Latrania Formation consists of up to 330 feet of coarse sandstone that commonly interfingers with coarse-grained alluvial conglomerate layers (Deméré, 2006). This unit lacks mud and silt, suggesting it is an inner to subtidal deposit (Deméré, 2006). The base of the Latrania Formation contains burrows into metamorphic limestone bedrock (Dorsey, 2006).

Fossils reported from the Latrania Formation of the Imperial Group include abundant and diverse assemblages of late Miocene and Pliocene marine invertebrates; primarily corals, mollusks, and echinoderms, although sponges and worm traces also occur (Powell, 2008; Schremp, 1981). The most common vertebrate fossils include bones and teeth of sharks, rays, bony fishes, sea turtle, sea cow, baleen whale, and camel (Deméré and Walsh, 1993; Deméré, 1993; 2006; Dorsey, 2006). Numerous other descriptions of fossils from the Imperial Group have been published. The SDNHM has two previously recorded fossil localities within one mile of the project area, and these produced numerous mollusk shells (see Table 1) (Randall, 2010). The LACM has two previously recorded fossil localities in the general vicinity of the Project area (see Table 1). One of these produced fossil mammal remains (camel) in association with gastropods and bivalves in Fossil Canyon. The second locality produced the holotype specimen of the fossil sea lion *Valenictus imperialensis* (McLeod, 2010; Mitchell, 1961). Because it produces locally abundant, diverse and scientifically important vertebrate and invertebrate fossils, the Latrania Formation of

the Imperial Group has very high paleontologic potential (PFYC Class 5). The Latrania Formation is limited to small exposures located just to the west of the northeast corner of the project area (Ti, Figure 2).

8.6 Palm Spring Formation

The Plio-Pleistocene Palm Spring Formation was named by Woodring (1931) for a several thousand meter thick sequence of non-marine sandstone, siltstone and claystone that overlie the marine Imperial Group. Cassiliano (2002) elevated the Palm Spring Formation to the Palm Spring Group consisting of the following formations: Arroyo Diablo, Olla, Tapiado Claystone, and Huesos. For the purpose of this analysis and for consistency with the geologic mapping, the term Palm Spring Formation is used in this report.

The Palm Spring Formation is composed of interbedded light gray conglomerate, arkosic sandstone and claystone. The entire Palm Spring sequence is interpreted as representing a mixed fluvial and deltaic depositional facies prograding from the prehistoric Colorado River delta (Cassiliano, 2002). According to Dibblee (1954), the formation is up to 6,500 feet thick north of Carrizo creek and thins to the west where it grades into the Canebrake Conglomerate, which is a basin margin facies containing granitic and metamorphic debris from the prehistoric adjacent mountains (Morton, 1977).

The Palm Spring Formation has produced over 100 species of Plio-Pleistocene fossil vertebrates including skulls, teeth, and/or bones of amphibians (frog), reptiles (tortoise, lizard, snake), birds (loon, grebe, pelican, condor, flamingo, duck, hawk, eagle, turkey, quail, crane, coot, owl, and crow), and mammals (shrew, mole, bat, ground sloth, rabbit, squirrel, gopher, kangaroo rat, woodrat, vole, wolf, coyote, fox, short-faced bear, raccoon, skunk, badger, jaguar, horse, tapir, camel, llama, deer, pronghorn, and mammoth) (Deméré and Walsh, 1993; Lundelius et al., 1987; San Diego DPW, 2007). Fossil localities just south of due east of the southern margin of the Project area in the Yuha Basin have produced fossil cat, camel, and horse (McLeod, 2010). Elsewhere in the formation, particularly in the Anza-Borrego Desert State Park, numerous vertebrate and invertebrate localities have been recorded (Jefferson, 2010; McLeod, 2010; Randall, 2010). The Palm Spring Formation has been noted to be of particular scientific importance because its Irvingtonian-Blancan faunas provide critical information for our understanding of the evolution and diversification of Pliocene-Pleistocene paleocommunities (Casilliano, 2002). Because it produces locally abundant, diverse and scientifically important vertebrate and invertebrate fossils, the Palm Spring Formation has very high paleontologic potential (PFYC Class 5). The Palm Spring Formation outcrops in the northwestern, northeastern, and southeastern portions of the project area (Tps, Figure 2).

8.7 Older Alluvium

Pleistocene older alluvium consists of poorly consolidated silts, sands, and gravels containing poorly sorted angular clasts derived from nearby mountains, and forming desert pavement terraces coated with desert varnish between dry washes and along upper margins of valleys (Dibblee, 2008a).

Older alluvial deposits are known to locally contain fossils of scientific importance in southern California. Deposits of similar age and lithology in the Coyote Mountains and the Vallecito-Fish Creek badlands in Anza-Borrego State Park have produced terrestrial vertebrate fossils (Randall,

2010). Additionally, the LACM has a locality in older alluvium to the south-southeast of the Project area west of Calexico that yielded a fossil horse (Equidae) (McLeod 2010) (see Table 1). Because it contains scattered but scientifically important fossil vertebrate remains of scientific importance, older alluvium has moderate paleontologic potential (PFYC Class 3a). Deposits of older alluvium occur in the western portion of the Project area (Qoa, Figure 2).

8.8 Alluvium and Terrace Deposits

Most of the Project area is underlain by Holocene age alluvium and terrace deposits. These unconsolidated sediments consist of mostly locally-derived sand, silt, clay and conglomerate deposited in valleys and on floodplains as the modern landscape evolved (Morton, 1977).

Deposits of Holocene age contain the unfossilized remains of modern species, and are generally considered too young to preserve fossil remains. However, at depth, deposits mapped as Holocene at the surface may well contain fossils because the deeper deposits may be of Pleistocene age (McLeod, 2010). For example, as noted by Jefferson (2010), Springer et al. (2009) documented scientifically Pleistocene significant fossils in a similar setting below Holocene deposits in Diamond Valley, Riverside County. Because surficial deposits of Holocene age sediments are too young to contain in-situ fossils, they have low paleontologic potential (PFYC Class 2). It should be noted however that construction excavations into Holocene alluvium and terrace deposits could expose fossils in underlying Pleistocene alluvium. Deposits mapped as Holocene alluvium and terrace deposits occupy most of the surface of the Project area (Qa, Qt, Figure 2).

9.0 Museum Record Search Results

Paleontological record searches for this Project were completed at the San Diego Natural History Museum (SDNHM), Anza-Borrego Desert State Park (ABDSP-DSRC), and the Natural History Museum of Los Angeles County (LACM). Copies of the record search results are appended to this report (Appendix A).

The record search results are summarized below in Table 1. None of the institutions have any previously recorded fossils localities within the Project area boundaries, although all of them have localities nearby in the same formations that occur within the Project area.

The SDNHM has three previously recorded fossil localities within a one mile radius of the Project area. SDSNH Locality 4372 (Alverson Formation) produced teeth of sciurid and hetermomyid rodents, as well as unidentified mammalian remains. SDSNH Locality 351 (Latrania Formation) produced bivalve shells belonging to the families Strombinidae, Pectinidae, Bullidae, Architectonicidae, and Lucinidae. SDSNH Locality 2698 (Latrania Formation) produced bivalve shells belonging to the family Pectinidae (Randall, 2010). Additionally, the SDNHM has numerous other previously recorded fossil localities in the Latrania Formation and Palm Spring Formation.

The ABDSP-DSRC has previously recorded fossil localities (number and precise location not provided) in the sedimentary facies of the Alverson Formation located in the Volcanic Hills approximately nine miles northwest of the project area (Jefferson, 2010), and numerous additional fossil localities recorded in Neogene age rocks within Anza-Borrego Desert State Park.

The LACM has seven previously recorded fossil localities in the general vicinity of the Project area. The closest fossil locality is LACM Locality 1403 (Imperial Formation) is located just north of the Project area, and produced a specimen identified as Camelidae (camel), in association with fossil gastropods and bivalves. LACM (CIT) 472 (Imperial Formation) is located almost due north of the eastern boundary of the Project area in the lower reaches of Painted Gorge, and produced the holotype specimen of the fossil walrus *Valenictus imperialensis* that was described by E.D. Mitchell (1961). LACM localities 1718 and 4098, 4099 and 4100 (Palm Spring Formation) are situated just south of due east of the southern margin of the Project area in the Yuha Basin south of Yuha Wash, and produced specimens of the cat *Felis*, the camel *Titanotylopus*, and the horse *Equus*. The LACM has numerous additional fossil localities in the Palm Spring Formation, but they are located in the Carrizo badlands to the northwest of the

Table 1. Summary of previously recorded fossil localities near the Ocotillo Express Wind Express Project area in Imperial County, California.

Institution and Locality Number	Formation and Age	Fossils
SDNHM 351	Latrania Formation (Imperial Group), late Miocene and Pliocene	Strombinidae, Pectinidae, Bullidae, Architectonicidae, Lucinidae
SDNHM 2698	Latrania Formation (Imperial Group), late Miocene and Pliocene	Pectinidae
SDNHM 4372	Alverson Formation (sedimentary facies), middle Miocene	Heteromyidae, Sciuridae, Mammalia undetermined
ABDSP-DSRC, locality numbers not provided	Alverson Canyon Formation (sedimentary facies), middle Miocene	Fossil inventory list not provided
LACM 1403	Imperial Formation, late Miocene and Pliocene	Camelidae
LACM (CIT) 472	Imperial Formation, late Miocene and Pliocene	Holotype: *Valenictus imperialensis*
LACM 1718, 4098, 4099, 4100	Palm Spring Formation, Pliocene and Pleistocene	*Felis, Titanotylopus, Equus*
LACM 1719	Older Quaternary deposits	Equidae

Project area. LACM Locality (Older Quaternary deposits) 1719 is situated east-southeast of the Project area west of Calexico and Mount Signal, and produced a specimen of fossil horse (Equidae) (McLeod, 2010).

9.1 Preliminary Potential Fossil Yield Classification of Project Area

Based on the results of the literature and museum record searches, the geologic formations within the Project area were ranked using the PFYC (see Section 7.0). The results are summarized in Table 2, and are projected on a paleontological sensitivity map (Figure 3). This map groups the geologic formations based on their PFYC rankings, and was used to calculate the acreages of areas recommended for inclusion in the pre-construction pedestrian field survey. The PFYC rankings below were initially recommended by Aron and Kelly (2010) as part of the pre-survey paleontological assessment, and were approved by the BLM as part of the document review process. Following the completion of the field survey, and as described in Section 10.0 of this report, the PFYC rankings were updated based on existing conditions observed within the Project area during the pedestrian field survey.

Table 2. Preliminary Fossil Yield Classification Rankings for the Ocotillo Wind Express Project.

Formation/Map Unit	Age	PFYC Ranking	Acres
Intrusive igneous basement rocks	Late Triassic to Jurassic	1	1,226.24
Split Mountain	Middle Miocene	3b	161.28
Alverson (sedimentary facies)	Middle Miocene	3a	773.824
Latrania (Imperial Group)	Late Miocene and Pliocene	5	8.00
Palm Spring	Pliocene and Pleistocene	5	436.915
Older Alluvium	Pleistocene	3a	2260.262
Terrace deposits	Holocene (possibly Pleistocene at depth)	2	424.096
Alluvium	Holocene (possibly Pleistocene at depth)	2	9710.982

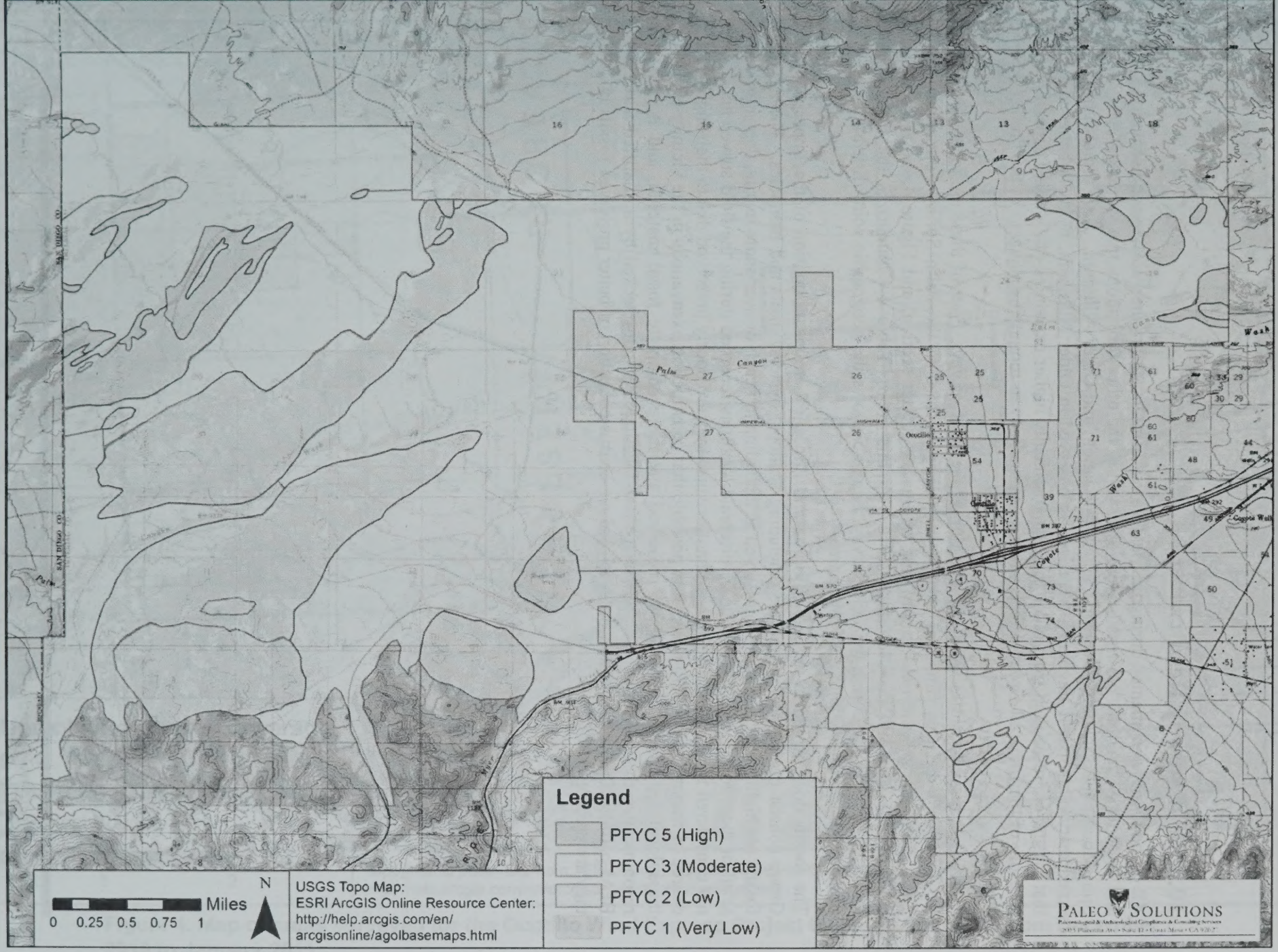

Figure 3. Paleontological sensitivity map of the Ocotillo Wind Express Project using the Potential Fossil Yield Classification System (1 = very low potential; 2 = low potential; 3 = moderate or unknown potential; 5 = high potential).

10.0 Field Survey Results

All of the fossils documented during the field survey were located in the Palm Spring Formation and Latrania Formation. No fossils were observed in the other formations that were surveyed: Split Mountain Formation, Alverson Canyon Formation, and Older Alluvium. It should also be noted that bivalve shell fragments were locally observed in Older Alluvium, but it is believed that these were re-worked from older and topographically higher exposures of a marine deposit, possibly of the Imperial Group which outcrops extensively in mountains adjacent to the Project area.

Thirty four fossil localities were recorded during the field survey. Four of these are located in the Latrania Formation (Imperial Group) and 30 are located in the Palm Spring Formation. Table 3 summarizes the field survey data by quarter-quarter section, and Figure 4 shows the geographic extent of Paleo Solutions surveys in this area. Table 4 summarizes the fossil localities documented during the field survey. Figure 5 shows the geographic point distribution of the fossil localities within the Project area.

The fossils documented in the late Miocene and Pliocene Latrania Formation of the Imperial Group consist of marine invertebrates including scallops, oysters, snails and barnacles. These fossils are highly fragmentary and preserved as a coquina in beach or near shore marine deposits at all of these localities. The marine invertebrate localities recorded during the field survey are not considered to be scientifically significant because they are poorly preserved due to their high degree of fragmentation. However, it is possible that construction excavations in the vicinity of these localities could unearth better preserved and more complete fossil material, and it is recommended that construction activities at these localities be spot-checked by a qualified and BLM permitted paleontologist in order to obtain a census collection of better preserved fossils if they are present.

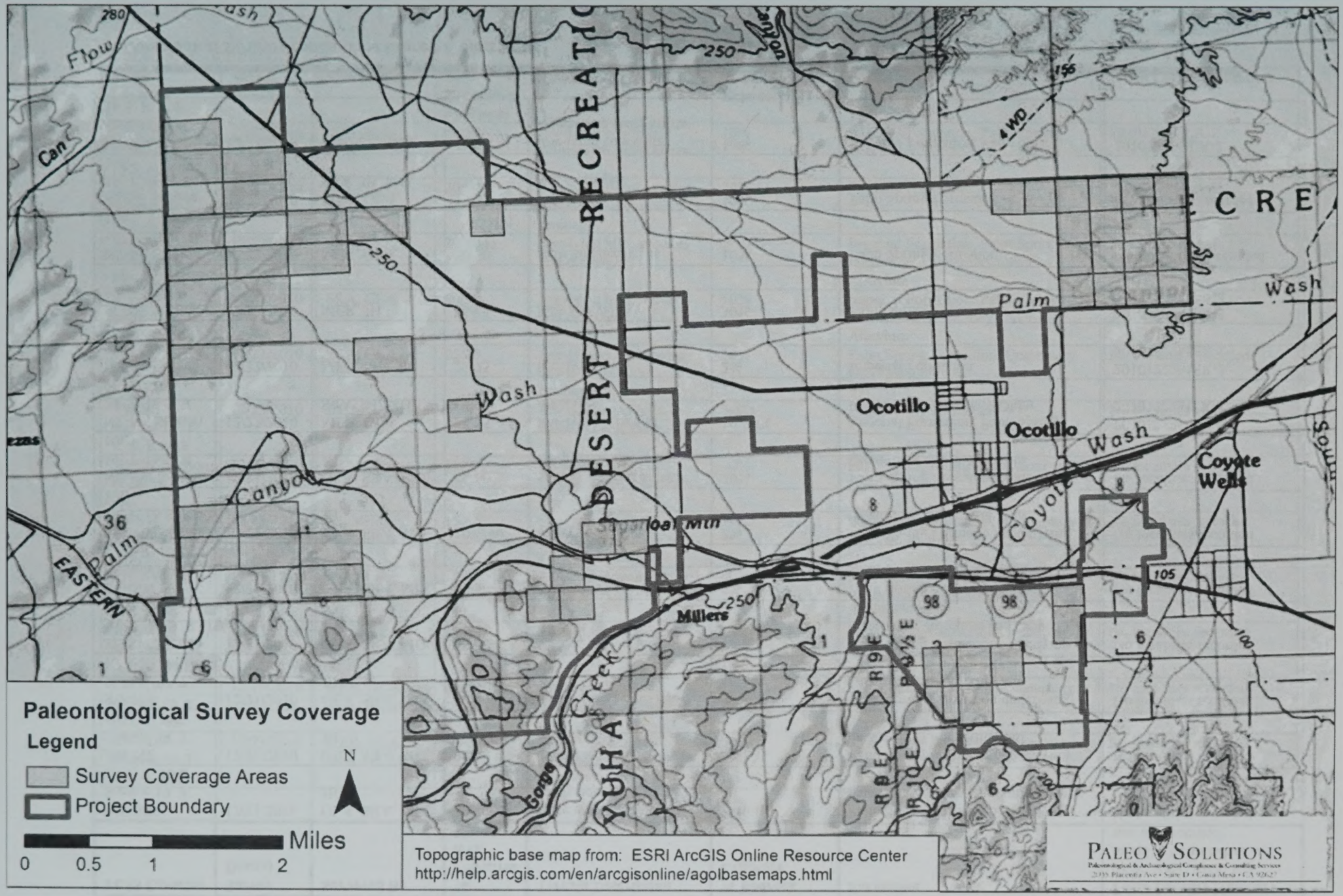

Figure 4. Map of areas surveyed for the Ocotillo Wind Express Project by Paleo Solutions from December 2010 to January 2011.

Table 3. Paleontological Field Survey Data Summary: Ocotillo Wind Express Project, Imperial County, California.

PLSS Location	Survey Date(s)	Surveyed By	% Pedestrian vs. Visual	Terrain Description	% Bedrock Exposure	Formation	Fossil Locality Numbers (note: fossil wood was found to be abundant and was not recorded)
NW-SW Section 19, T. 16 S, R. 10 E	12/21/2010	GLA, SRA, MD, JH	30/70	ridge with drainage on south side	99%	Palm Spring Formation underlying Quaternary Older Alluvium	No localities recorded
NW-NE Section 19, T. 16 S, R. 10E	12/21/2010	GLA, SRA, MD, JH	90/10	hills and valleys	5%	Palm Spring Formation underlying Quaternary Older Alluvium	No localities recorded
SW-NW Section 19, T. 16 S, R. 10E	12/21/2010	GLA, SRA, MD, JH	50/50	2 low-lying ridges and valley	99%	Palm Spring Formation underlying Quaternary Older Alluvium	No localities recorded
SE-SW Section 19, T. 16 S, R. 10E	12/21/2010	GLA, SRA, MD, JH	80/20	valleys, ridges, large wash.	40%	Palm Spring Formation underlying Quaternary Alluvium and capped with desert pavement	No localities recorded
SW-SW Section 19, T. 16 S, R. 10E	12/21/2010	GLA, SRA, MD, JH	50/50	steep hills and valleys	5%	Palm Spring Formation underlying Quaternary Older Alluvium	No localities recorded
SE-NW Section 19, T. 16 S, R. 10E	12/21/2010	GLA, SRA, MD, JH	10%/90	valleys and ridges	2%	Palm Spring Formation underlying Quaternary Older Alluvium	No localities recorded
NE-SW Section 19, T. 16 S, R. 10E	12/21/2010	GLA, SRA, MD, JH	40/60	valleys and ridges with flat plain to northwest	30%	Palm Spring Formation underlying Quaternary Older Alluvium	No localities recorded
NE-NE Section 24, T. 16 S, R. 9E	12/22/2010	MER, GLA, SRA, JH, MD	25/75	low-lying hills and drainages	10-20%	Imperial Formation, Palm Spring Formation, Quaternary Older Alluvium	20101222GLA-1, 20101222MER-1
NW-NE Section 24, T. 16 S, R. 9E	12/22/2010	MER, MD, JH	25/75	low-lying hills	2%	Imperial Formation	20101222MER-2, 20101222MER-1
SE-NE Section 19, T.16 S, R. 10E	12/22/2010	MER, JH	35/65	hills and valleys	30%	Palm Spring Formation	20101222MER-3, 20101222MER-4
NE-SE Section 19, T16S, R 10E	12/22/2010	MER, GLA, SRA, JH, MD	50/50	Hills and drainages	10%	Palm Spring Formation	No Localities Recorded
SE-SE Section 19, T. 16 S, R. 10E	12/22/2010	MER, GLA, SRA, JH, MD	15/85	low-lying hills, mounds and drainages	10%	Palm Spring Formation	No localities recorded
NW-NE Section 19, T. 16 S, R. 10E	12/22/2010	MD, GL, SRA	50/50	low-lying concentric ridges with sharp crests	10%	Imperial Formation, Palm Spring Formation	20101222GLA-2

Table 3. Continued.

PLSS Location	Survey Date(s)	Surveyed By	% Pedestrian vs. Visual	Terrain Description	% Bedrock Exposure	Formation	Fossil Locality Numbers
SW-NE Section 19, T. 16 S, R. 10E	12/22/2010	MD, GLA, SRA	50/50	low-lying concentric ridges with sharp crests	10%	Imperial Formation, Palm Spring Formation	20101222GLA-2
SE-NW Section 19, T. 16 S, R. 10E	12/22/2010	MD, GLA, SRA	20/80	parallel curving, crested ridges, low-lying, with drainages	20%	Imperial Formation	20101222GLA-2
NE-NW Section 19, T. 16 S, R. 10E	12/22/2010	SRA, GLA	20/80 to 1/99	low-lying hills, mounds and drainages	5-10%	Imperial Formation, Palm Spring Formation, Quaternary Older Alluvium	20101222GLA-1, 20101222GLA-2
NW-NW Section 19, T. 16 S, R. 10E	12/22/2010	SRA, GLA	50/50	low-lying hills, mounds and drainages	10%	Imperial Formation, Palm Spring Formation, Quaternary Older Alluvium	20101222GLA-1, 20101222GLA-2
SW-SE Section 19, T. 16 S, R. 10E	12/23/2010	SRA, GLA	25/75	low-lying hills, sloping to the south with drainages to the north	10%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
NW-SE Section 19, T. 16 S, R. 10E	12/23/2010	JH, MD, MER	40/60	low ridges and hills, basin in the middle	3-5%	Palm Spring Formation	No localities recorded
SE-SW Section 19, T. 16 S, R. 10E	12/23/2010	SRA, GLA	15/85	low-lying hills and alluvial slope wash with drainages	10%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
NE-SW Section 18, T. 16 S, R. 9E	12/23/2010	JH, MER, GLA, SRA, MD	15/85	small part in south center of sub quarter has low ridges and hillsides	1%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
NW-SW, Section 18, T. 16 S, R. 9E	12/23/2010	JH, MER, GLA, SRA, MD	15/85	hills and canyon approx. 100 ft deep	40%	Palm Spring Formation, Quaternary Older Alluvium, Quaternary terrace deposits	No localities recorded
SE-SW, Section 18, T. 16 S, R. 9E	12/23/2010	MER, GLA, SRA, JH, MD	40/60	Steep hills and slopes, drainages and washes	20%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
SW-NW Section 19, T. 16 S, R. 9E	12/23/2010	MER, GLA, SRA, JH, MD	60/40	Ridges and canyons trending to northwest	15%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
NW-NW Section 19, T. 16 S, R. 9E	12/23/2010	MER, GLA, SRA, JH, MD	60/40%	Steep hills and drainages/washes	30%	Palm Spring Formation, Quaternary alluvium	No localities recorded

Table 3. Continued.

PLSS Location	Survey Date(s)	Surveyed By	% Pedestrian vs. Visual	Terrain Description	% Bedrock Exposure	Formation	Fossil Locality Numbers
NE-SW Section 19, T. 16 S, R. 9E	12/27/2010	MER, GLA, SRA, JH, MD	80/20%	Badlands with washes	51.5%	Palm Spring Formation	20101227MER-4, 20101228MER-1, 20101228MER-2, 20101228MER-3
SE-SW Section 19, T. 16 S, R. 9E	12/27/2010	MER, GLA, SRA, JH, MD	80/20%	Badlands, canyons with finger ridges and gullies	50%	Palm Spring Formation	20101227-MER-1, 20101227MER-2, 20101227MER-3, 20101227JH-1, 20101227JH-2, 20101227JH-3, 201201227GLA-1, 20101227GLA-2a, 20101227GLA-2b, 20101227SRA-1, 20101227SRA-2
NW-SE Section 19, T. 16 S, R. 9E	12/28/2010	MER, GLA, SRA, JH, MD	50/50%	Badlands, canyons with ridges, washes, and gullies	20%	Palm Spring Formation	20101228MRD-1
SW-NE Section 19, T. 16 S, R.9E	12/28-12/29 2010	MER, GLA, SRA, JH, MD	60/40%	Badlands with low ridges and canyons	10%	Palm Spring Formation	20101228MER-4, 20101228MER-5, 20101228GLA-1, 20101228GLA-3, 20101228GLA-9, 20101229PM-1, 20101229PM-2, 20101229JH-1, 20101228MRD-2
SE-NW Section 19, T. 16 S, R. 9E	12/28/2010	MER, GLA, SRA, JH, MD	80/20%	Finger ridges, gullies, and large washes, steep slope wash; badlands	50%	Palm Spring Formation	20101228PM-1
NW-NE Section 19, T. 16 S, R. 9E	12/28/2010	MER, GLA, SRA, JH, MD	25/75%	Badlands with washes	10%	Palm Spring Formation	20101228MRD-1
NE-NE Section 19, T. 16 S, R. 9E	12/28/2010	MER, GLA, SRA, JH, MD	5/95%	Badlands and flatlands with washes	5%	Palm Spring Formation	No localities recorded
NW-SE Section 33, T. 16 S, R. 9E	12/29/2010	SRA, MER	2/98%	Steep slopes and flat lands	1%	Alverson Canyon Volcanics	No localities recorded

Table 3. Continued.

PLSS Location	Survey Date(s)	Surveyed By	% Pedestrian vs. Visual	Terrain Description	% Bedrock Exposure	Formation	Fossil Locality Numbers
NW-NE Section 20, T. 16 S, R. 9E	12/29/2010	MER, GLA, SRA, JH, MD	20/80%	Badlands	20%	Palm Spring Formation	20101229JH-2, 20201229MER-1
NE-SW Section 33, T. 16 S, R. 9E	12/29/2010	MRD, JH	10/90%	Steep bluffs and slopes	8%	Alverson Canyon Volcanics	No localities recorded
NE-NE Section 30, T. 16 S, R. 9E	12/30/2010	MER, GLA, SRA, JH, MD	5/95%	Low-lying ridges and gullies	1%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
NE-SW Section 29, T. 16 S, R. 9E	12/30/2010	MER, GLA, SRA, JH, MD	1/99%	Low lying hills	0.5%	Palm Spring Formation, Quaternary Older Alluvium	No localities recorded
NW-SW Section 1, T. 16 1/2S, R. 9 1/2 E	12/30/2010	MER, GLA, SRA, JH, MD	30/70%	Canyon flanked by low ridges	5%	Palm Spring Formation, Split Mountain Formation, Alverson Canyon Volcanics	No localities recorded
SW-SW Section 1, T. 16 1/2S, R 9 1/2 E	12/30/2010	MER, GLA, SRA, JH, MD	80/20%	Canyon, ridges, associated gullies	20%	Palm Spring Formation, Split Mountain Formation, Alverson Canyon Volcanics	No localities recorded
NE-NE Section 1, T. 16 1/2S, R. 9 1/2 E	12/30/2010	MER, GLA, SRA, JH, MD	25/75%	Low-lying ridges and shallow canyons	1%	Palm Spring Formation	No localities recorded
SE-NE Section 1, T. 16 1/2S, R. 9 1/2E	12/30/2010	MER, GLA, SRA, JH, MD	70/30%	Low-lying ridges, shallow canyons and associated washes between ridges	45%	Palm Spring Formation	No localities recorded
NE-SE Section 1, T. 16 1/2S, R. 9 1/2E	12/30/2010	GLA, MRD	20/80%	Low-lying ridge and shallow canyon	3%	Palm Spring Formation	No localities recorded
NE-SE Section 2, T. 16 1/2S, R. 9 1/2E	12/30/2010	MER, GLA, SRA, JH, MD	30/70%	Canyon flanked by low ridges	5%	Palm Spring Formation, Split Mountain Formation, Alverson Canyon Volcanics	No localities recorded
SW-SE Section 2, T. 16 1/2S, R. 9 1/2E	12/30/2010	SRA, GLA	25/75%	Flatland, washes and ridges (eroded)	7%	Palm Spring Formation, Split Mountain Formation, Alverson Canyon Volcanics	No localities recorded
SE-SE Section 2, T. 16 1/2S, R. 9 1/2E	12/30/2010	SRA	80/20%	Canyon with gullies and low ridges	15%	Palm Spring Formation, Split Mountain Formation, Alverson Canyon Volcanics	No localities recorded

Table 3. Continued.

PLSS Location	Survey Date(s)	Surveyed By	% Pedestrian vs. Visual	Terrain Description	% Bedrock Exposure	Formation	Fossil Locality Numbers
NW-SE Section 2, T. 16 1/2S, R. 9 1/2E	12/30/2010	MER, JH, SRA, GLA	30/70%	Canyon flanked by low ridges	5%	Palm Spring Formation, Split Mountain Formation, Alverson Canyon Volcanics	No localities recorded
SW-SW Section 33, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	2/98%	Hills, slopes, washes, saddles	4-7%	Alverson Canyon Volcanics, Quaternary Older Alluvium	No localities recorded
NW-NE Section 3, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	5/95%	Hills, slopes, washes, saddles	5-10%	Alverson Canyon Volcanics, Quaternary Older Alluvium	No localities recorded
NE-NW Section 3, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	5/95%	Hills, ravines and washes	5%	Alverson Canyon Volcanics	No localities recorded
SW-SE Section 31, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	10/90%	Steep canyon and hill slopes, with dune deposits surrounding volcanics	2%	Alverson Canyon Volcanics, sand dunes, Quaternary alluvium, Quaternary Older Alluvium	No localities recorded
NW-SE Section 31, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	5/95%	Steep canyon, hills with dune deposits, hill slopes	1-2%	Alverson Canyon Volcanics, Quaternary Older Alluvium	No localities recorded
NE-SW Section 31, T. 16S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	5/95%	Steep canyon, hill slopes, dune deposits	1-2%	Alverson Canyon Volcanics, Quaternary alluvium, Quaternary Older Alluvium, sand dunes	No localities recorded
NW-SW Section 31, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	2/98%	Flat drainage, bounded by drainage cut exposing Quaternary Older Alluvium to the north	1%	Quaternary Older Alluvium	No localities recorded
SE-NW Section 31, T. 16 S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	1-2/98%	Wide flat Wash with drainage cut bank exposing to NW Quaternary Older Alluvium and Alverson Canyon Volcanics on SE of Quarter-Quarter	1%	Quaternary Older Alluvium, Alverson Canyon Volcanics in SE corner	No localities recorded
SW-NW Section 31, T. 16S, R. 9 E	1/5/2011	MER, SRA, GLA, MRD	2/98%	Mild sloping from NE being truncated by wash in SE corner. Vertical along the cut rim, with eroding sediments of decomposed granite at angle of repose down to wash	1%	Quaternary Older Alluvium	No localities recorded
NW-NW Section 30, T 16S, R 9E	1/6/2011	MER, GLA, MRD	20/80%	Steep canyon with steep slopes	2%	Quaternary Older Alluvium, Palm Spring Formation	No localities recorded

Table 4. Paleontological Locality Summary: Ocotillo Wind Express Project, Imperial County, California.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element) (note: fossil wood was found to be abundant and was not recorded)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101222GLA-1	Latrania Formation (Imperial Group)	Late Miocene and Pliocene	Light tan-brown medium sandstone	*Ostrea* spp. Pectinidae Cirripedia	Poor-good	No	Spot-check construction excavations to obtain census collection of better preserved, less fragmentary fossils if preserved in sub surface
20101222GLA-2	Latrania Formation (Imperial Group)	Late Miocene and Pliocene	Light tan-brown medium sandstone	*Ostrea* spp. Pectinidae	Poor-good	No	Spot-check construction excavations to obtain census collection of better preserved, less fragmentary fossils if preserved in sub surface
20101222MER-1	Latrania Formation (Imperial Group)	Late Miocene and Pliocene	Medium yellow-brown sandstone	Pectinidae *Ostrea* spp.	Poor-good	No	Spot-check construction excavations to obtain census collection of better preserved, less fragmentary fossils if preserved in sub surface
20101222MER-2	Latrania Formation (Imperial Group)	Late Miocene and Pliocene	Medium yellow-brown sandstone	Pectinidae *Ostrea* spp. Gastropoda	Poor-good	No	Spot-check construction excavations to obtain census collection of better preserved, less fragmentary fossils if preserved in sub surface
20101222MER-3	Palm Spring	Plio-Pleistocene	Medium gray sandstone	Mammalia undetermined, long bone shaft fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101222MER-4	Palm Spring	Plio-Pleistocene	Variable conglomerate	Mammalia undetermined, 3 long bone shaft fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227JH-1	Palm Spring	Plio-Pleistocene	Yellowish-brown sandstone	Mammalia undetermined, bone fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227JH-2	Palm Spring	Plio-Pleistocene	Medium-brown sandstone	Mammalia undetermined, 2 long bone shaft fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227JH-3	Palm Spring	Plio-Pleistocene	Gray and yellowish-brown sandstone	Testudines, 2 carapace fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227MER-1	Palm Spring	Plio-Pleistocene	Light gray sandstone	Testudines, carapace fragment Mammalia, undetermined bone fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101227MER-2	Palm Spring	Plio-Pleistocene	Light yellowish-brown sandstone	Aves undetermined, long bone shaft fragment Mammalia undetermined, bone fragments Mammalia undetermined, edentulous dentary fragment and tooth fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227MER-3	Palm Spring	Plio-Pleistocene	Light yellowish-brown sandstone	Aves undetermined, 2 long bone shaft fragments Mammalia undetermined, 6 long bone shaft fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227MER-4	Palm Spring	Plio-Pleistocene	Yellowish-tan sandstone	Testudines, 4 marginal carapace fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227SRA-1	Palm Spring	Plio-Pleistocene	Reddish-brown sandstone	Testudines, 3 costal carapace fragments Mammalia undetermined, 2 long bone shaft fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101227SRA-2	Palm Spring	Plio-Pleistocene	Reddish-tan sandstone	Mammalia undetermined, 1 bone fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227GLA-1	Palm Spring	Plio-Pleistocene	Light grayish-white sandstone	Mammalia undetermined, 4-5 bone fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227GLA-2a	Palm Spring	Plio-Pleistocene	Light grayish-tan sandstone	Testudines, 2 partial costals	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101227GLA-2b	Palm Spring	Plio-Pleistocene	Light tan-whitish to grayish-tan sandstone	Mammalia undetermined, 1 bone fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101228MRD-1	Palm Spring	Plio-Pleistocene	Light brown sandstone	Testudines, 1carapace fragment with ornamentation Testudines, 1 marginal fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101228MRD-2	Palm Spring	Plio-Pleistocene	Light brown sandstone	Lagomorpha, 7 bone fragments including distal tibia and partial vertebra	Good	No, could not re-locate fossils for collection subsequent to BLM approval	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101228PCM-1	Palm Spring	Plio-Pleistocene	Tan sandstone	Mammalia undetermined, humerus fragments (approximately 20) without articulation	Good	No, could not re-locate fossils for collection subsequent to BLM approval	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101228MER-1	Palm Spring	Plio-Pleistocene	Light yellowish-brown sandstone	Mammalia undetermined, 2 vertebral centra Testudines, 2 carapace fragments Mammalia undetermined, 6 bone fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101228MER-2	Palm Spring	Plio-Pleistocene	Light yellowish-brown sandstone	Testudines, 2 carapace fragments Mammalia undetermined, 3 bone fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101228MER-3	Palm Spring	Plio-Pleistocene	Light yellowish-brown sandstone	Osteichthyes undetermined, 1 vertebra Mammalia undetermined, 2 flat pieces of bone	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101228MER-4	Palm Spring	Plio-Pleistocene	Light grayish-yellow sandstone	Mammalia undetermined, 1 long bone fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Testudines, 1 carapace fragment			
				Testudines, 1 marginal carapace fragment			
20101228MER-5	Palm Spring	Plio-Pleistocene	Light grayish-brown sandstone	Artiodactyla, cf. camelidae, 1 distal phalanx	Good	Phalanx and vertebral centrum collected 1/06/2011, bone fragments not collected	Avoid locality because presence of surface fossils indicates potential for additional scientifically significant subsurface vertebrate fossils
				Mammalia undetermined, 1 vertebral centrum			
				Mammalia undetermined, 4+ bone fragments			

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101228GLA-1	Palm Spring	Plio-Pleistocene	Tan sandstone	Mammalia undetermined, phalanx and tarsal bone	Good	Partial surface collection 1/06/2011. Phalanx and tarsal bone not re-located subsequent to BLM approval to collect fossils	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Mammalia, 1 partial vertebra			
				Mammalia undetermined, 1 bone fragment			
				Testudines, 2 carapace fragments			
20101228GLA-3	Palm Spring	Plio-Pleistocene	Light grayish-tan sandstone	Mammalia undetermined, fragment of humerus	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Testudines, marginal carapace fragment			
				Mammalia undetermined, ischium fragment			

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101228GLA-9	Palm Spring	Plio-Pleistocene	Tan sandstone	Artiodactyla undetermined, molar enamel fragment	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Testudines, 2 carapace fragments with preserved sutures			
				Mammalia undetermined, 4 bone fragments			
20101229-MER-1	Palm Spring	Plio-Pleistocene	Gray sandstone	Testudines, 2 partial plastron scutes	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101229PM-1	Palm Spring	Plio-Pleistocene	Light brown sandstone	Testudines, 2 plastron fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Mammalia undetermined, 7 bone fragments			

Table 4. Continued.

Locality #	Formation	Age	Lithology	Fossil Types (taxa/element)	Preservation Notes	Fossils Collected?	Additional Mitigation Recommendations
20101229PM-2	Palm Spring	Plio-Pleistocene	Tan-orange sandstone	Mammalia undetermined, 7 bone fragments including distal femur with patellar groove	Poor	Testudines fossils collected 1/6/2011, other fossils were not re-located subsequent to BLM approval to collect fossils	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Testudines, 19 carapace and plastron fragments			
				Cf. Aves undetermined bone fragment			
20101229JH-1	Palm Spring	Plio-Pleistocene	Medium brown sandstone	Testudines 1 carapace fragment with sutures	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
20101229JH-2	Palm Spring	Plio-Pleistocene	Light brown sandstone	Testudines, 4 carapace fragments and possibly associated bone fragments	Poor	No	Avoid locality because presence of surface fossils indicates potential for additional but scientifically significant subsurface vertebrate fossils
				Mammalia undetermined,, 5 bone fragments			

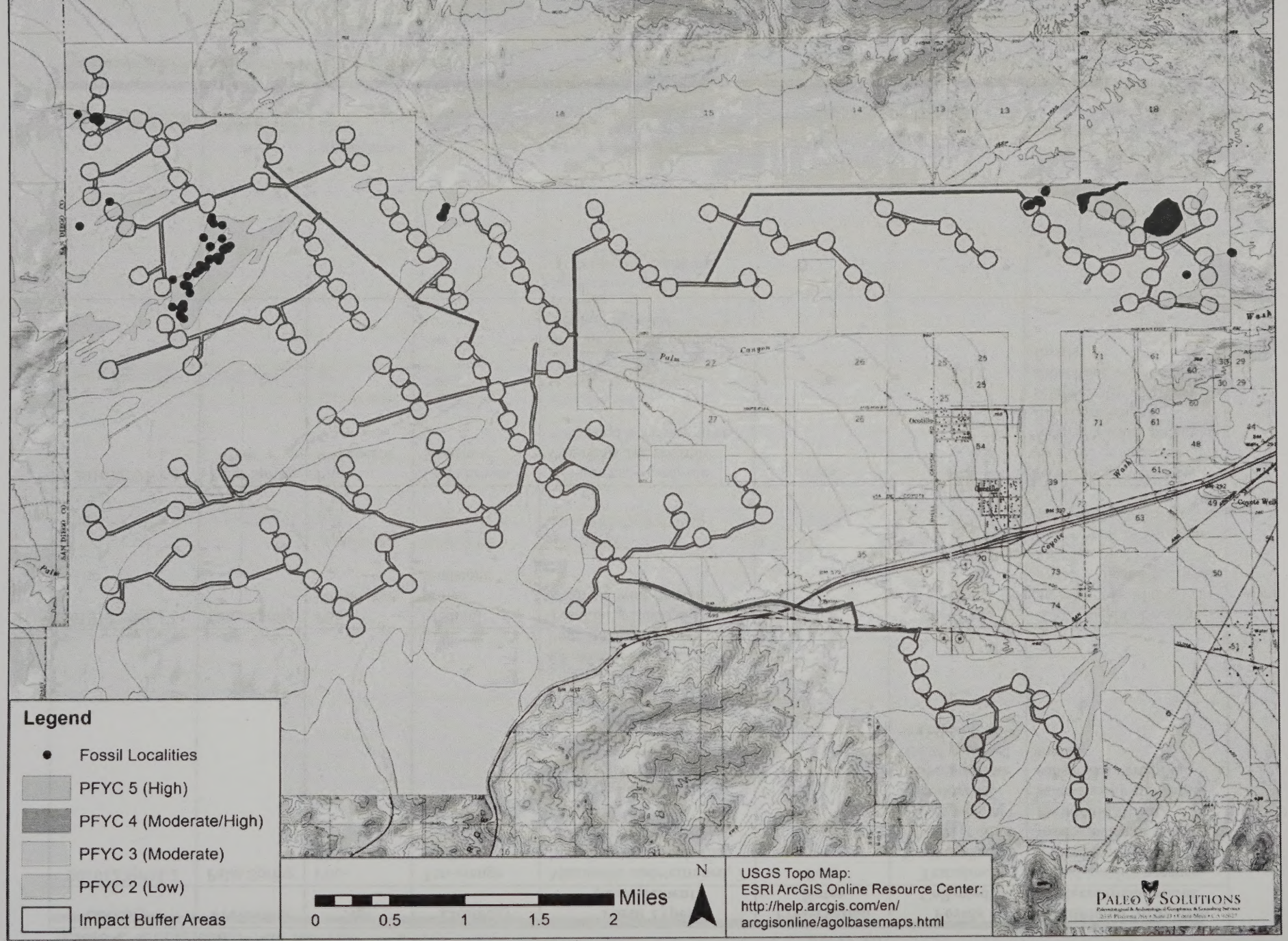

Figure 5. Geographic distribution of all vertebrate and invertebrate fossil localities documented during the field survey. Note that fossil plant localities were not recorded due to the large number of fossil wood occurrences in the Palm Spring Formation throughout the Project area.

The fossils at the 30 localities documented in the Pliocene and Pleistocene Palm Spring Group consist of plants and vertebrates. The plants consist of fragmentary but locally well preserved silicified wood, some of which shows evidence of encrustation by fossil algae. Some near complete logs were also observed. It became readily apparent during the initial days of the field survey that fossil wood is so abundant throughout the Project area that it would be impractical to record wood localities. Vertebrate fossils are far more rare, and consist mostly of fragments of turtle shell (carapace and plastron) and mammalian bone and tooth enamel. Most of the mammalian fossils show evidence of a high degree of fluvial transport, and are unidentifiable due to their fragmentary nature and lack of diagnostic morphology, and as such, they lack scientific significance. Nevertheless, the presence of bone fragments on the surface indicates the potential for additional and potentially scientifically significant subsurface fossils at these localities. Therefore, all Palm Spring Formation fossil localities are recommended for avoidance by the Project.

Five of the Palm Spring Formation fossil localities contained surface fossils that were believed to be well-preserved to be diagnostic, and were therefore deemed to have scientific significance (see Table 4). At the conclusion of the field survey, a request was made to the BLM to re-visit these fossil localities and collect the fossils, and the request was approved. However, due to intervening heavy rains and the small size of the fossils, only three of the localities were re-located and collected (Table 5). The fossils collected include 16 specimens consisting of turtle carapace and plastron fragments and limb elements; camelid post-crania including a distal 1st phalanx of the extinct llama cf. *Hemiauchenia* sp., a lumbar vertebral centrum of the extinct camel cf. *Camelops* sp.; an unidentified artiodactyl astragalus, a lumbar vertebra (proximal portion of right transverse process) of an unidentified artiodactyl, and unidentified mammal bones collected from the Palm Spring Formation (written communication, G. Jefferson, ABDSP-DSRC, 2011). Although the Palm Spring Formation vertebrate fossils documented during the survey are fragmentary and generally poorly preserved, they do include remains that are identifiable to taxon and element, provide new records of fossils from an area in which fossil localities have not been previously documented, and provide important new information concerning the paleoenvironmental history of the region.

All fossils collected during the field survey were prepared, identified, and transferred to ABDSP-DSRC for permanent museum storage in January, 2011. Appendix C is a copy of the curation agreement letter provided by ABDSP-DSRC. Appendix D is a copy of the signed BLM repository receipt form for specimens that were delivered to ABDSP-DSRC. Appendix E includes all of the BLM locality forms, maps and photographs for fossil localities documented during the field survey.

All of the Palm Spring Formation fossil localities are located in two larger areas that are recommended for avoidance by project-related surface disturbance because of the high density of fossil localities recorded in these areas during the field survey (see Figure 6). Based on the Project Proposed Action, these avoidance areas are currently not located within the area of potential effect, but it is recommended that they be avoided by future surface disturbing actions in order to preserve the fossils in their native geologic context for the benefit of future scientific research efforts. If avoidance is not feasible, then any surface disturbing actions in these areas should be monitored by qualified and BLM permitted paleontologists.

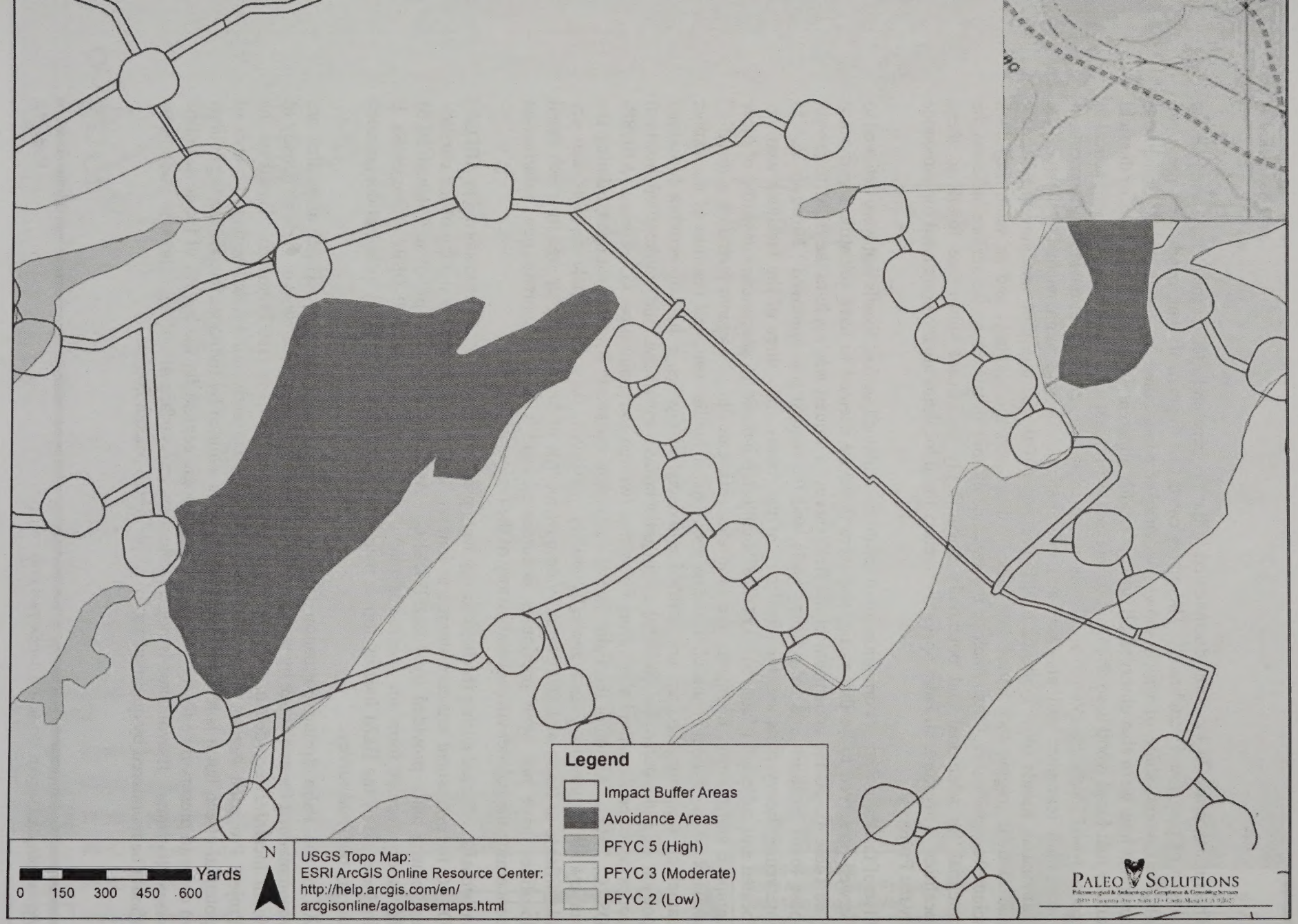

Figure 6. Areas of Palm Spring Formation recommended for Project avoidance. Note that these areas lie outside of the current area of potential effect (areas of surface disturbance) of the Project Proposed Action.

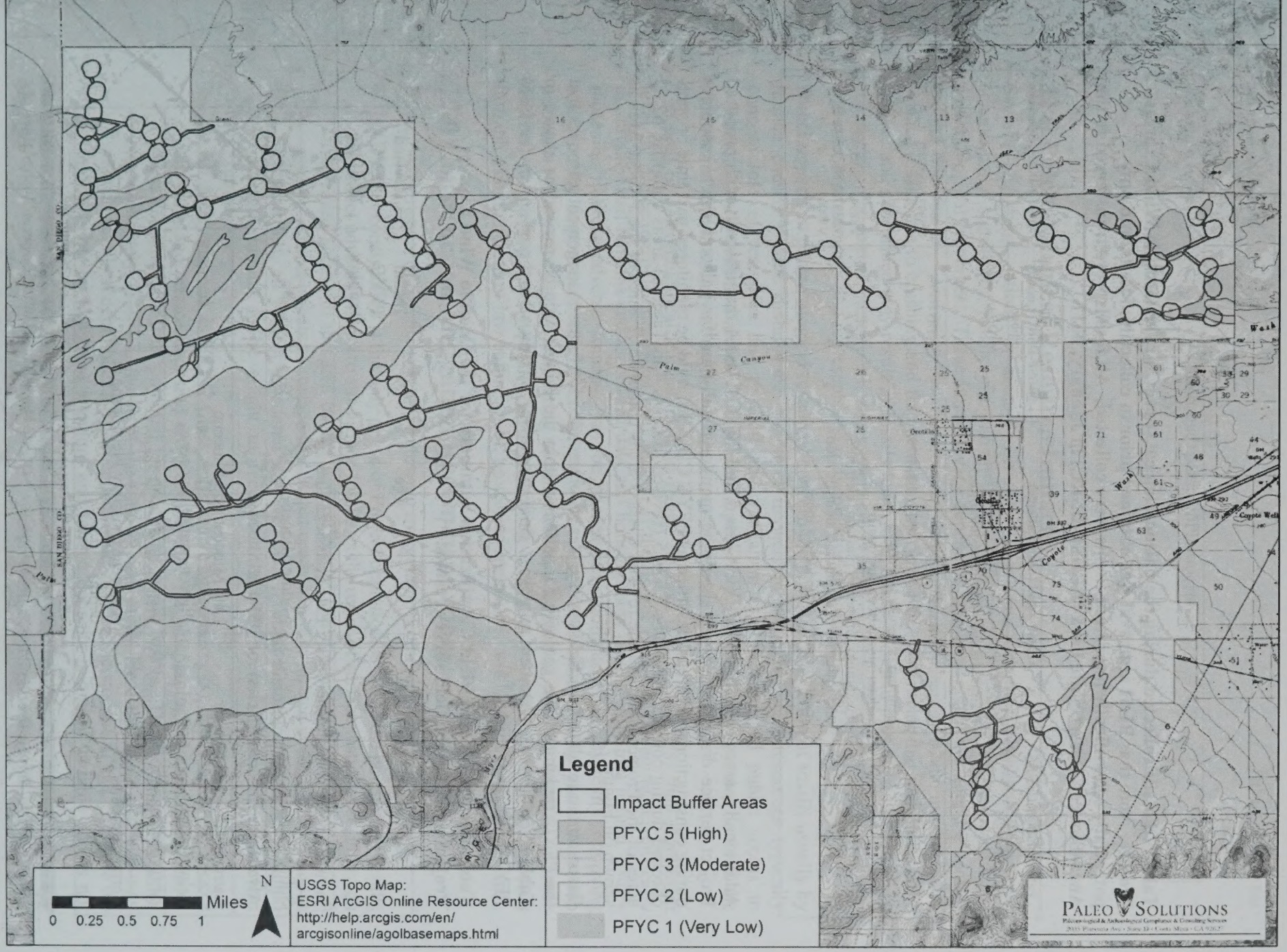

Figure 7. Map showing areas on overlap between the Project area of potential effect and PFYC Class 5 areas (63 acres) within the Project boundary.

Table 5. Fossils collected during the paleontological survey for the Ocotillo Wind Express Project. Note that BLM approval was obtained prior to collecting fossils, and only potentially scientifically important fossils were collected. All fossils were transferred to the Anza-Borrego Desert State Park (ABDSP-DSRC) in January, 2011.

Paleo Solutions Locality Number	ABDSP Fossil Identification(s)	ABDSP-DSRC Locality Number	ABDSP-DSRC Specimen Numbers
20101228MER-5	*Hemiauchenia* sp., distal 1st phalanx; mammalia indeterminate, juvenile vertebral epiphysis	3465	V8885, V8886
20101228GLA-1	Testudines plastron, limb (2 individuals?); cf. *Camelops* sp., posterior centrum of lumbar vertebra; indeterminate bone fragments	3466	V8889, V8890, V8891, V8892, V8893
20101229PM-2	Testudines, primarily plastron, elements and lower level taxonomic identification indeterminate, Artiodactyla indet., astralagus	3467	V8894, V8895, V8896, V8897, V8898, V8899, V8900

Additionally, areas classified as PFYC Class 5 and PFYC Class 4 that intersect with proposed Project surface disturbance areas should be monitored full-time for paleontological resources during construction, and areas classified as PFYC Class 3 should be monitored part time or spot-checked during construction. The Class 5 (revised to Class 4 in Table 6) areas comprise 62.47 acres of the Project area, and the revised Class 3 areas comprise .7 acres of the Project Area as shown on Figure 7.

Based on the results of the field survey, it is recommended for future management purposes that the PFYC ranking of the geologic formations within the Project area be revised as shown in Table 6 for future management purposes. Both the pre-survey (initial) and post-survey (revised) PFYC rankings are listed.

Table 6. Revised Fossil Yield Classification Summary for the Ocotillo Wind Express Project based on the field survey results.

Formation/Map Unit	Age	Initial PFYC Ranking	Revised PFYC Ranking
Intrusive igneous basement rocks	Late Triassic to Jurassic	1	1
Split Mountain	Middle Miocene	3b	3b
Alverson (sedimentary facies)	Middle Miocene	3a	2
Latrania (Imperial Group)	Late Miocene and Pliocene	5	3a
Palm Spring	Pliocene and Pleistocene	5	4
Older Alluvium	Pleistocene	3a	2
Terrace deposits	Holocene (possibly Pleistocene at depth)	2	2

Alluvium	Holocene (possibly Pleistocene at depth)	2	2

11.0 Paleontological Resource Impacts

Surface disturbing actions in areas (sedimentary geologic formations) known to contain scientifically significant fossils are known to produce adverse impacts on non-renewable paleontological resources. These impacts vary depending upon the depth and lateral extent of ground disturbance. Activities that disturb only the ground surface may result in impacts to surface fossils due to crushing and fragmentation beyond repair. Activities that disturb both the surface and subsurface may result in fossils located on the surface and preserved in subsurface sediments. The loss of these fossils and associated results in a permanent loss of an educational and scientific resource, and represents a significant adverse environmental impact.

Direct impacts to paleontological resources concern the physical destruction of fossils usually by human caused ground disturbance. Indirect impacts to paleontological resources typically concern loss of resources due to theft and vandalism due to increased public access to paleontologically sensitive areas. Cumulative impacts to paleontological resources concern the incremental loss to society as a whole of these non-renewable resources.

The goal of paleontological mitigation is to reduce adverse impacts to a less than significant level by protecting paleontological resources or if this is not possible, salvaging scientifically important fossil remains and associated data and housing them permanently in a natural history museum. Direct adverse impacts can be successfully mitigated by physically removing scientifically important fossils from the path of construction either during pre-construction paleontological survey or by monitoring of construction excavations. Indirect impacts are more difficult to mitigate, and typically involve limiting access to scientifically important fossils through a combination of law enforcement, protective enclosures, and land access to restrictions.

12.0 Construction Mitigation Recommendations

Based on the results of the analysis, the following mitigation recommendations are made:

1) Project construction is the only phase of Project operations that has the potential to results in direct adverse effects to subsurface fossils as the result of surface disturbance, although increased access to the area by the general public and Project personnel may result in greater indirect effects to surface fossils that erode onto the surface in the future. Prior to construction, all Project personnel involved with ground disturbing operations should undergo training to be taught to recognize the presence of fossils in construction excavations.
2) All areas mapped as PFYC Class 1 (intrusive igneous rocks) and Class 2 (Holocene alluvium and terrace deposits) are recommended for paleontological clearance because these deposits have little potential for producing in-situ fossils. These deposits comprise approximately 11,361.32 acres of the total Project area. Note that these deposits may contain fossils at depth because deeper sediments may be Pleistocene in age. Because the thickness of the Holocene alluvium and terrace deposits is highly variable and is not

precisely known, it is recommended that construction personnel working in these areas notify the BLM Authorized Officer immediately should any potential fossils be encountered.

3) Four Latrania Formation fossil localities were documented during the field survey. If construction-related disturbance intersects with these localities, they should be monitored full-time during construction in order to check for the presence of more complete and better preserved (scientifically significant) fossils. If present, a census collection of these fossils should be collected.
4) All of the Palm Spring Formation (PFYC Class 5/revised PFYC Class 4) fossil localities should be avoided by construction-related ground disturbance, and these are located in two larger areas that are also recommended for avoidance by project-related surface disturbance because of the high density of fossil localities recorded in these areas during the field survey (see Figure 6). Based on the Project Proposed Action, these avoidance areas are currently not located within the area of potential effect, but it is recommended that they be avoided by future surface disturbing actions in order to preserve the fossils in their native geologic context for the benefit of future scientific research efforts.
5) All areas delineated as Class 3 (Revised in Table 6) should be monitored part-time or spot-checked during construction-related activities involving surface disturbance. These areas include areas mapped as the Latrania and Split Mountain Formations in the Revised PFYC Table.
6) Prior to construction, all Project personnel should be briefed on the types of paleontological resources that they could encounter during construction as part of the workers environmental and safety training.
7) During construction and during future Project operations, the BLM Authorized Officer should be notified immediately if any fossils are encountered by construction or other Project personnel.
8) A mitigation monitoring plan for paleontological resources should be prepared based on the results of this report in conjunction with the final selected Project alternative. This plan should specify procedures and protocols in the event of fossil discoveries, specific monitoring locations, and should be prepared according to BLM guidelines H8270-1 (BLM, 1998) and IM 2009-011 (BLM, 2008).
9) All fossils collected during construction must be transferred to a paleontological repository that meets federal DM-411 curation standards.

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Appendix A: Records Search Results

State of California • The Resources Agency
Arnold Schwarzenegger, *Governor*

DEPARTMENT OF PARKS AND RECREATION
Ruth Coleman, *Director*
Colorado Desert District Stout Research Center
Anza-Borrego Desert State Park
200 Palm Canyon Drive
Borrego Springs, California 92004

Jennifer Kelley
Paleo Solutions
2035 Placentia Avenue, Unit D
Costa Mesa, California 92627

Dear Ms Kelley,

03 July 2010

As per your request 28 June 2010, a search of the archival records, collections database and GIS data at the Colorado Desert District Stout Research Center (DSRC) for paleontological resources on lands within one mile of the proposed Ocotillo Wells Express wind farm project (Ocotillo Express 2009) was conducted 02 July 2010. No paleontological sites adjacent to or within this area were found on record.

As far as I am aware no paleontological surveys have been performed and/or reported for this area. However, geological formations known to be paleontologically sensitive that yield significant remains in Anza-Borrego Desert State Park (ABDSP) crop out within the project area (Division of Mines and Geology 1962, Ocotillo Express 2009).

Most of the project foot print seems to be underlain by Quaternary alluvium. Such sediments, usually with no known paleontologic signature at the surface, may yield significant fossils at shallow depths. For example, Quaternary alluvium in Diamond Valley, Riverside County, of similar lithology and depositional setting to that in the project area, was found contain very abundant and highly significant Pleistocene vertebrate remains (Springer et al. 2009). Given these findings, the sensitivity of Quaternary alluvium locally may be high, and it can not be assumed that such deposits do not contain significant fossil remains.

Although, most of the site is underlain by Quaternary alluvial deposits, geological mapping includes outcrops of Oligo-Miocene volcanics of the Alverson Formation (*Tv* on the Ocotillo Express geologic map) and sandstones and conglomerates probably of the Split Mountain Group or Red Rock Formation (*Mc* on the Ocotillo Express geologic map) within the project area. Such deposits are generally considered unfossiliferous. However, sediments interbedded with the Alverson volcanics within the Volcanic Hills (ABDSP) <15 km northwest of the project area, and mapped geologically as *Tv* (Division of Mines and Geology 1962), yield significant vertebrate remains and fossil woods (DSRC archives).

Given the potential of encountering significant fossils, it is recommended that a paleontological survey be preformed, that a qualified paleontological monitor be present

during all excavations or grading into *Tv* and Quaternary alluvial deposits, and that the Society of Vertebrate Paleontology (1995) mitigation standards be followed.

Three hours were spent in this endeavor by two District staff that bill at $70.00 per hour, for a total expense of $210.00. Please make a payment, via check to the *Anza-Borrego Foundation Paleontology* account, mailed to this office. The Foundation is a 501c-3 (33-0334338) non-profit organization. If you have any further questions concerning these findings, please feel free to contact me at 1-760-767-4974 or <gjefferson@parks.ca.gov>.

Sincerely,

George T. Jefferson

Colorado Desert District Paleontologist
Associate State Archaeologist

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Natural History Museum of Los Angeles County

900 Exposition Boulevard • Los Angeles, CA 90007

Vertebrate Paleontology Section
Telephone: (213) 763-3325
FAX: (213) 746-7431
e-mail: smcleod@usc.edu or smcleod@nhm.org

7 August 2010

Paleo Solutions, Inc.
2035 Placentia Avenue, Suite D
Costa Mesa, CA 92627

Attn: Geraldine L. Aron, Prinicpal

re: Paleontological resources for the proposed Ocotillo Wind Express Project, near Ocotillo, Imperial County, project area

Dear Geraldine:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed Ocotillo Wind Express Project, near Ocotillo, Imperial County, project area as outlined on the portions of the Carrizo Mountain, Painted Gorge, In-Ko-Pah Gorge, and Coyote Wells USGS topographic quadrangle maps that Jennifer Kelly sent to me via e-mail to me on 28 June 2010. We do not have any vertebrate fossil localities that lie within the project boundaries, but we do have localities nearby from the same sedimentary deposits that occur within the proposed project areas.

In the very southwestern portion of the proposed project areas there are exposures of plutonic igneous rocks as well as exposures of extrusive igneous rocks of the Alverson Canyon Volcanics. These rocks, of course, will be devoid of recognizable vertebrate fossils. In the southwestern portion of the southeastern parcel of the proposed project areas south-southwest of Ocotillo there are exposures of the late Miocene Split Mountain Formation. The Split Mountain Formation is primarily composed of coarse grained sediments that are not conducive to producing significant vertebrate fossils and we have no vertebrate fossil localities properly assigned to the Split Mountain Formation.

In the very northeastern portion of the proposed project areas there may be exposures of the marine Pliocene Imperial Formation, and this rock unit may underlie the younger Palm Spring Formation exposed elsewhere in the proposed project areas. Our closest vertebrate fossil locality from the Imperial Formation is LACM 1403, situated just north of the proposed project area in Fossil Canyon, that produced a fossil specimen of camel, Camelidae, in association with fossil snails and molluscs. Our next closest fossil vertebrate locality from the Imperial Formation is LACM (CIT) 472, situated almost due north of the eastern boundary of the proposed project areas in the lower reaches of Painted Gorge, that produced the holotype specimen (a specimen that serves as the basis for describing a species new to science) of the fossil sea lion *Valenictus imperialensis*

described by E. D. Mitchell in 1961 (A new walrus from the Imperial Pliocene of southern California; with notes on odobenid and otariid humeri. Contributions in Science, Natural History Museum of Los Angeles County, 44:1-28).

Scattered throughout the proposed project areas there are exposures of the Plio-Pleistocene deposits of the Palm Spring Formation. Our closest vertebrate fossil localities from the Palm Spring Formation are LACM 1718 and 4098-4100, situated just south of due east of the southern margin of the proposed project areas in the Yuha Basin southeast of Yuha Wash, that produced fossil specimens of cat, Felis, camel, *Titanotylopus*, and horse, *Equus*. We have an enormous number of vertebrate fossil localities from the Palm Spring Formation, but they are concentrated in the Carrizo Badlands quite to the northwest of the proposed project area.

Most of the proposed project areas, however, have surficial deposits composed of younger Quaternary Alluvium, either as fan deposits from the more elevated terrain or as fluvial deposits from the drainages and particularly from Palm Canyon Wash, or older Quaternary terrace deposits. The younger Quaternary deposits typically do not contain significant vertebrate fossils, at least in the uppermost layers, and we have no vertebrate fossils localities anywhere nearby from such deposits. Our closest vertebrate fossil locality from the older Quaternary deposits is LACM 1719, situated east-southeast of the proposed project areas west of Calexico and Mount Signal, that produced a specimen of horse, Equidae.

Excavations in the igneous rocks exposed in the southwestern portions of the proposed project area will not uncover any fossils. Excavations in the coarse deposits of the Split Mountain Formation exposed in the southeastern parcel of the proposed project areas are unlikely to uncover significant vertebrate fossils. Shallow excavations in the younger Quaternary Alluvium exposed in much of the proposed project areas are also unlikely to uncover significant vertebrate fossils. Deeper excavations in those latter areas that extend down into older deposits, however, may well encounter significant vertebrate fossils. Any excavations in the Palm Spring Formation deposits, or deeper excavations that might extend down into the Imperial formation deposits, have a good chance of uncovering significant to highly significant fossil vertebrate remains. Any substantial excavations in the relatively fine-grained sedimentary deposits in the proposed project areas, therefore, should be monitored closely to quickly and professionally recover any fossil remains discovered while not impeding development. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: invoice

SAN DIEGO NATURAL HISTORY MUSEUM
BALBOA PARK - SAN DIEGO SOCIETY OF NATURAL HISTORY - ESTABLISHED 1874

6 July 2010

Jennifer Kelly
Paleo Solutions
2035 Placentia Ave, Unit D
Costa Mesa, CA 92627

RE: Paleontological record search; Ocotillo Wind Express Project

Dear Ms. Kelly:

This letter presents the results of a paleontological record search conducted for the Ocotillo Wind Express Project. This development project area is approximately 41,000 acres in size and includes two sites; both are in southwestern Imperial County along Interstate 8 and south of the Coyote Mountains. The larger and western most of the two sites is located north of the east bound lanes of Interstate 8, east of the Imperial County/San Diego County border, south of the Coyote Mountains, and northwest of the town of Ocotillo. The smaller and eastern most of the two sites is south of Interstate 8 and Ocotillo, and northeast of Davies Valley. The sedimentary rocks underlying the project site have been mapped by Dibblee (2008) and Morton (1971) as the Holocene-age (< 10,000 years old) alluvium, Holocene to late Pleistocene-age (~500,000 years old to present) older alluvium, Pliocene/Pleistocene age (approximately 1 to 4 million years old) Palm Spring Formation, late Miocene-age (5 – 6 million years old) Split Mountain Formation, and early Miocene-age (14 – 22 million years old) Alverson Volcanics).

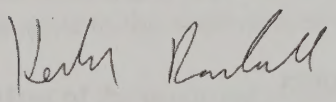
The San Diego Natural History Museum has 3 fossil localities within a one-mile radius of the project site (see attached map). One of the localities occurs within non-marine, sedimentary deposits of the Alverson Volcanics. This locality produced fossils of terrestrial vertebrates (e.g., rodents). Two of the localities occur within marine sandstones of the Latrania Formation, Imperial Group (Imperial Formation by Dibblee and Morton). These localities are not believed to crop out within the project boundaries. Although San Diego Natural History Museum fossil localities have not been discovered in other units underlying the project area, there is a potential for fossil discoveries. Older alluvium, Palm Spring Formation, and the Split Mountain Formation have been known to produce terrestrial vertebrates in the Coyote Mountains and the Vallecito-Fish Creek badlands of southern Anza-Borrego Desert State Park.

Grading activities associated with the proposed Ocotillo Wind Express Project have the potential to impact sedimentary deposits of the older alluvium, Palm Spring Formation, Split Mountain Formation, and Alverson Volcanics. Based on the records of fossil discoveries in the region, Deméré and Walsh (1993) have assigned the older alluvium, the Split Mountain Formation, and the Alverson Volcanics to have a moderate paleontological sensitivity, while the

Palm Spring Formation to have a high paleontological sensitivity. Any fossils recovered from the exposures made at the project site are likely to be scientifically significant we would recommend the implementation of a full paleontological mitigation program.

If you have any questions concerning these findings please feel free to contact me at 619-255-0310 or krandall@sdnhm.org.

Sincerely,



Kesler A. Randall
Collections Manager, Fossil Vertebrates
Department of Paleontology

Literature Cited:

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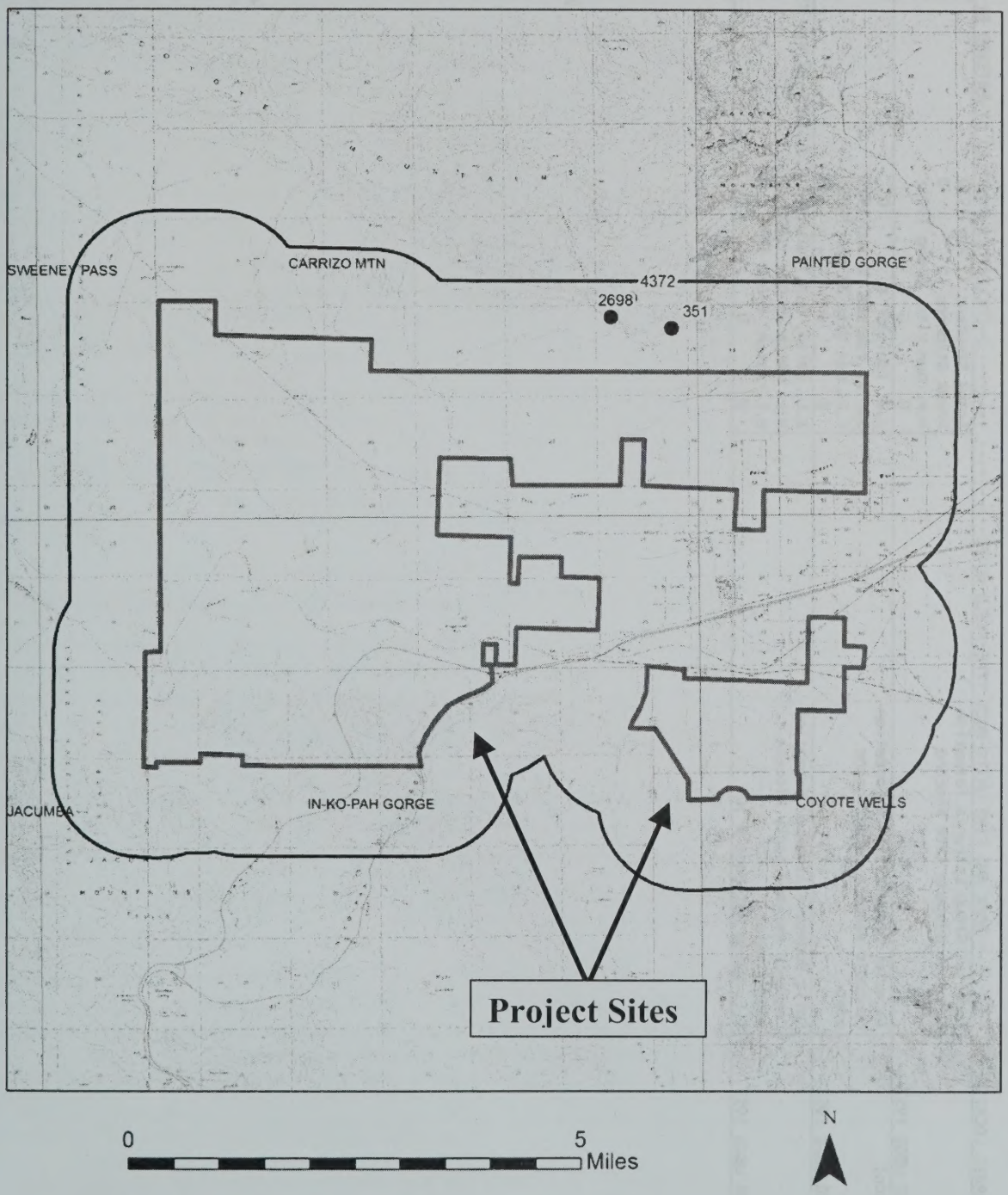


Fossil localities within a one-mile radius of the Ocotillo Wind Express Project sites, Imperial County, CA. (Base maps, In-Ko-Pah Gorge, Coyote Wells, Carrizo Mountain, and Painted Gorge, 7.5 minute quadrangles of the U.S. Geological Survey).

DATE 07/06/10
TIME 15:30:41

SAN DIEGO NATURAL HISTORY MUSEUM
DEPARTMENT OF PALEONTOLOGY
LOCALITY LIST

PAL120

NUMBER	---LOCALITY NAME AND GEOGRAPHIC LOCATION---	----------ROCK AND TIME UNITS-ROCK TYPE-FIELD NOTES----------	----------COLLECTORS-COMPILED BY-ENTERED BY-DONOR----------
351	Alverson Canyon Imperial Co. CA U.S.A. 0° 0' 0" -- 0° 0' 0" Carrizo Mountain, CA 1:24000 USGS 1957	Imperial Group Latrania Formation Cenozoic Neogene late Miocene sdst-	Frank Stephens 11 May 1930 Frank Stephens 0 0 H.P. Don Vito 8 Sep 1994 0 0
2698	Alverson Canyon (Shell Canyon) Imperial Co. CA U.S.A. 0° 0' 0" -- 0° 0' 0" Carrizo Mountain, CA 1:24000 USGS 1957	Imperial Group Latrania Formation Cenozoic Neogene late Miocene sdst-	J.W. Tobiska 0 0 Jan W. Tobiska 6 Jun 1975 H.P. Don Vito 31 Mar 1995 0 0
4372	Alverson Amphitheater Imperial Co. CA U.S.A. 32°47' 5"N--116° 0'46"W Carrizo Mountain, CA 1:24000 USGS 1957	Split Mountain Alverson Formation Cenozoic Neogene early Miocene sdst-fluvial S.L. Walsh Notebook # 10	S.L. Walsh, R.A. Cerutti, P.J. Sena 27 Nov 1999 S.L. Walsh 6 Dec 1999 S.L. Walsh 6 Dec 1999 0 0

Appendix B: Copy of BLM Paleontological Resource Use Permits

United States Department of the Interior
FIELDWORK REQUEST AND AUTHORIZATION
PALEONTOLOGICAL INVESTIGATIONS

DI Form 1991
(BLM Rev July 2005)
OMB No. 1024-0037

Authorization to conduct Paleontological studies on public lands managed by the Bureau of Land Management under the authority of:

☒ The Antiquities Act of 1906 (P.L. 59-209; 34 Stat. 225, 16 U.S.C. 431-433) and its regulations (43 CFR 3).

☒ Bureau-specific statutory and/or regulatory authority: Federal Land Policy and Management Act of 1976 (Public Law 94-570), and Section 302 of Public Law 94-4579

Please use this number when referring to this permit

No.: _____

1. Applicant (Business/Firm) and BLM State Permit Number Paleo Solutions Inc.; Permit# CA-10-00-006P	**2. Application date:** 12/1/2010
3. Address 2035 Placentcia Ave, Suite D Costa Mesa, CA 92627	**4. Telephone number(s)** 562-818-7713
	5. E-mail address(es) geraldine@paleosolutions.com
6. Name of Permit Administrator Geraldine Aron **Telephone number(s):** 562-818-7713 **Email address(es):** geraldine@paleosolutions.com	**7. Name of Principal Investigator(s)** Geraldine Aron **Telephone number(s):** 562-818-7713 **Email address(es):** geraldine@paleosolutions.com
8. Name of Field Director(s) authorized to carry out field projects Geraldine Aron and Scott Armstrong	**Telephone number(s):** 562-818-7713 and 949-813-1240 **Email address(es):** geraldine@paleosolutions.com and scott@paleosolutions.com

9. Nature of paleontological fieldwork proposed:

☒ **Survey and limited surface collection.** ☐ **Excavation**

Briefly describe:

Paleo Solutions will survey with limited surface collections all areas mapped as PFYC Class 3a,3b, and 5 which comprise 3632 acres of the project. The entire project encompasses approximately 15,000 acres.

10. Location of proposed work (attach topographic map copy with project boundaries
See attached map

11. Dates of proposed work: **From:** 12/15/2010 **To:** 3/15/2011

12. Name and address of the curatorial facility in which collections, records, data, photographs, and other documents resulting from work under this permit shall be deposited for permanent preservation on behalf of the United States Government.

San Diego Natural History Museum

13. Permittee is required to observe the listed standard permit conditions and the special permit conditions attached to this permit

14. Signature and title of applicant:	**15. Date** 12/6/10
16. Signature and title of approving official:	**17. Date**

18. Standard Permit Conditions

a. This permit is subject to all applicable provisions of 43 CFR Part 3, 43 CFR 7, and 25 CFR 262, and applicable departmental and bureau policies and procedures, which are made a part hereof.

b. The permittee and this permit are subject to all other Federal, State, and local laws and regulations applicable to the public lands and resources.

c. This permit shall not be exclusive in character, and shall not affect the ability of the land managing bureau to use, lease or permit the use of lands subject to this permit for any purpose.

d. This permit may not be assigned.

e. This permit may be suspended or terminated for breach of any condition or for management purposes at the discretion of the approving official, upon written notice.

f. This permit is issued for the term specified in 11 above.

g. Permits issued for a duration of more than one year must be reviewed annually by the agency official and the permittee.

h. The permittee shall obtain all other required permit(s) to conduct the specified project.

i. Permittee shall immediately request that the approving official (14. above) make a modification to accommodate any change in an essential condition of the permit, including individuals named and the nature, location, purpose, and time of authorized work, and shall without delay notify the approving official of any other changes affecting the permit or regarding information submitted as part of the application for the permit. Failure to do so may result in permit suspension or revocation.

j. Permittee may request permit extension, in writing, at any time prior to expiration of the term of the permit, specifying a limited, definite amount of time required to complete permitted work.

k. Any correspondence about this permit or work conducted under its authority must cite the permit number. Any publication of results of work conducted under the authority of this permit must cite the approving bureau and the permit number.

l. Permittee shall submit a copy of any published journal article and any published or unpublished report, paper, and manuscript resulting from the permitted work (apart from those required in items q. and s., below), to the approving official and the appropriate official of the approved curatorial facility (item 12 above).

m. Permittee may request a review, in writing to the official concerned, of any disputed decision regarding inclusion of specific terms and conditions or the modification, suspension, or revocation of this permit, setting out reasons for believing that the decision should be reconsidered.

n. Permittee shall not be released from requirements of this permit until all outstanding obligations have been satisfied, whether or not the term of the permit has expired. Permittee may be subject to civil penalties for violation of any term or condition of this permit.

15. Standard Permit Conditions (continued)

o. Permittee shall submit a preliminary report to the approving official within a timeframe established by the approving official, which shall be no later than 6 weeks after the completion of any episode of fieldwork, setting out what was done, how it was done, by whom, specifically where, and with what results, including maps, GPS data, and the permittee's professional recommendations, as results require. If other than 6 weeks, the timeframe shall be specified in Special Permit Condition p. Depending on the scope, duration, and nature of the work, the approving official may require progress reports, during or after the fieldwork period or both, and as specified in Special Permit Condition r.

p. Permittee shall submit a clean, edited draft final report to the agency official for review to insure conformance with standards, guidelines, regulations, and all stipulations of the permit. The schedule for submitting the draft shall be determined by the agency official.

q. Permittee shall submit a final report to the approving official not later than 180 days after completion of fieldwork. Where a fieldwork episode involved only minor work and/or minor findings, a final report may be submitted in place of the preliminary report. If the size or nature of fieldwork merits, the approving official may authorize a longer timeframe for the submission of the final report as specified in Special Permit Condition q.

r. Two copies of the final report, a completed NTIS Report Documentation Page (SF-298), available at http://www.ntis.gov/pdf/rdpform.pdf, will be submitted to the office issuing the permit.

s. The permittee agrees to keep the specific location of sensitive resources confidential. Sensitive resources include threatened species, endangered species, and rare species, archeological sites, caves, fossil sites, minerals, commercially valuable resources, and sacred ceremonial sites.

t. Permittee shall deposit all artifacts, samples and collections, as applicable, and original or clear copies of all records, data, photographs, and other documents, resulting from work conducted under this permit, with the curatorial facility named in item 12, above, not later than 90 days after the date the final report is submitted to the approving official. Not later than 180 days after the final report is submitted, permittee shall provide the approving official with a catalog and evaluation of all materials deposited with the curatorial facility, including the facility's accession and/or catalog numbers.

u. Permittee shall provide the approving official with a confirmation that museum collections described in t. above were deposited with the approved curatorial facility, signed by an authorized curatorial facility official, stating the date materials were deposited, and the type, number and condition of the collected museum objects deposited at the facility.

v. Permittee shall not publish, without the approving official's prior permission, any locational or other identifying site information that could compromise the Government's protection and management of the site.

w. For excavations, permittee shall consult the OSHA excavation standards which are contained in 29 CFR §1926.650, §1926.651 and §1926.652. For questions regarding these standards contact the local area OSHA office, OSHA at 1-800-321-OSHA, or the OSHA website at http://www.osha.gov.

x. Special permit conditions attached to this permit are made a part hereof.

16. Special Permit Conditions

☒ a. Permittee shall allow the approving official and bureau field officials, or their representatives, full access to the work area specified in this permit at any time the permittee is in the field, for purposes of examining the work area and any recovered materials and related records.

☒ b. Permittee shall cease work upon discovering any human remains and shall immediately notify the approving official or bureau field official. Work in the vicinity of the discovery may not resume until the authorized official has given permission.

☒ c. Permittee shall backfill all subsurface test exposures and excavation units as soon as possible after recording the results, and shall restore them as closely as reasonable to the original contour.

☒ d. Permittee shall not use mechanized equipment in designated, proposed, or potential wilderness areas unless authorized by the agency official or a designee in additional specific conditions associated with this permit.

☒ e. Permittee shall take precautions to protect livestock, wildlife, the public, or other users of the public lands from accidental injury in any excavation unit.

☒ f. Permittee shall perform the fieldwork authorized in this permit in a way that does not impede or interfere with other legitimate uses of the public lands, except when the authorized officer specifically provides otherwise.

☒ h. Permittee shall restrict vehicular activity to existing roads and trails unless the authorized officer provides otherwise.

☒ i. Permittee shall keep disturbance to the minimum area consistent with the nature and purpose of the fieldwork.

☒ j. Permittee shall not cut or otherwise damage living trees unless the authorized officer gives permission.

☒ k. Permittee shall take precautions at all times to prevent wildfire. Permittee shall be held responsible for suppression costs for any fires on public lands caused by the permittee's negligence. Permittee may not burn debris without the authorized officer's specific permission.

☒ l. Permittee shall conduct all operations in such a manner as to prevent or minimize scarring and erosion of the land, pollution of the water resources, and damage to the watershed.

☒ m. Permittee shall not disturb resource management facilities within the permit area, such as fences, reservoirs, and other improvements, without the authorized officer's approval. Where disturbance is necessary, permittee shall return the facility to its prior condition, as determined by the authorized officer.

☒ n. Permittee shall remove temporary stakes and/or flagging, which the permittee has installed, upon completion of fieldwork.

☒ o. Permittee shall clean all camp and work areas before leaving the permit area. Permittee shall take precautions to prevent littering or pollution on public lands, waterways, and adjoining properties. Refuse shall be carried out and deposited in approved disposal areas.

☐ p. Permittee shall submit the preliminary report within _____ days/weeks of completion of any episode of fieldwork..

☐ q. Permittee shall submit the final report within _____ days/weeks/months after completion of fieldwork..

☐ r. Permittee shall submit progress reports every _____ months over the duration of the project.

☒ s. California special permit conditions are attached.

Special Permit Conditions Continuation Sheet: California Conditions

- a. Work under this permit is limited to specific service approved for each permit. This may consist of non-collection survey, limited testing to determine site content and limits or extensive testing emergency excavation and/or salvage projects
- b. Permittees shall verbally and subsequently in writing contact the appropriate BLM Field Manager prior to the beginning of each of his field operations (with follow-up written notification) to inform the BLM of specific work to be conducted. At this time, the BLM Field Manager may impose additional stipulation as deemed necessary to provide for the protection and management of resource values in the general site or project area.
- c. All cultural artifacts and other related materials such as notes, photographs, etc., acquired under the provisions of this permit remain the property of the United States Government and may be recalled at any time for the use of the Department of the Interior or other agencies of the Federal Government. Cultural materials collected under the provisions of this permit must be curated at a repository approved by the BLM. Curation shall be at a local qualified repository, if feasible, and an approved curation facility shall be designated prior to all field projects. An itemized list of all materials with accession numbers, curated at the repository will be submitted to the State Office and to the appropriate Field Office within 180 days of the completion of individual field projects. A copy of a receipt from the curation facility must be submitted with the list or catalogue.
- d. Permittees shall acquire a primary number from the appropriate Information Center for each cultural resource documented while undertaking work authorized by this permit.
- e. The BLM Field Manager or authorized representative may require a monthly letter progress report outlining what was accomplished. This report, if required, is due by the fifth day of the following month, unless different arrangements are approved.
- f. The individual(s) in direct charge must be academically qualified and possess adequate field experience. At least two weeks prior to initiation field work, the permittees must provide the BLM Field Manager with the vitae of individuals proposed to be in direct charge if not approved at the time of permit issuance. A list of field crew members should be submitted at the same time. Only the individual(s) listed in Item No. 8 of the permit is/are authorized to be in direct charge of field work conducted under this permit.
- g. The person(s) in direct charge of field work, shall be on site at all times when work is in progress. Failure to comply with permit stipulations will result in removal of subject's name(s) from the approved list of person-in-direct-charge.
- h. Care should be exercised to avoid directly or indirectly increasing access or potential vandalism to sensitive sites.
- i. All National Permit Stipulations are binding. The authority for issuing permits in the Bureau of Land Management rests solely with the State Director as Delegated by the Secretary of the Interior and all further delegation is prohibited by Secretarial Order. No Modification of National Permit Conditions 8 or 9 or of the California Special Permit Conditions may occur except by written decision of the State Director.
- j. The Bureau of Land Management shall be cited in any report of work done under this permit, including publications such as books, news articles and scientific publications, as well as oral reports, films, television programs, and presentations in other media.

By signing below, I, the Principal Investigator, acknowledge that I have read and understand the Permit for Paleontological Investigations and agree to its terms and conditions as evidenced by my signature below and initiation of work or other activities under the authority of this permit.

Signature and title: GERALDINE ATEN, PRINCIPAL INVESTIGATOR

Date: 14/6/10

Paperwork Reduction Act and Estimated Burden Statement: This information is being collected pursuant to 16 U.S.C. 470cc and 470mm, to provide the necessary facts to enable the Federal land manager (1) to evaluate the applicant's professional qualifications and organizational capability to conduct the proposed archeological work; (2) to determine whether the proposed work would be in the public interest; (3) to verify the adequacy of arrangements for permanent curatorial preservation, as United States property, of specimens and records resulting from the proposed work; (4) to ensure that the proposed activities would not be inconsistent with any management plan applicable to the public lands involved; (5) to provide the necessary information needed to complete the Secretary's Report to Congress on Federal Archeology Programs; and (6) to allow the National Park Service to evaluate Federal archeological protection programs and assess compliance with the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470). Submission of the information is required before the applicant may enjoy the benefit of using publicly owned archeological resources. To conduct such activities without a permit is punishable by felony-level criminal penalties, civil penalties, and forfeiture of property. A federal agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a valid OMB control number. Public reporting for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Departmental Consulting Archeologist; NPS; 1849 C Street, NW (2275); Washington, DC 20240-0001.

PALEO SOLUTIONS
Paleontological & Archaeological Compliance & Consulting Services
2035 Placentia Ave • Suite D • Costa Mesa • CA 92627

Paleontological Resources Research Design and Survey Strategy for the Ocotillo Wind Express Project, Imperial County, California.

1. Project Description/Introduction

Pattern Energy, through Ocotillo Express LLC (OE LLC), proposes to construct, operate, maintain and decommission a 561 megawatt (MW) wind generation facility on approximately 14,980 acres in the Ocotillo Express wind project area (Figure 1). OE LLC acquired from Greenhunter, another developer, its rights to approximately 5,915 acres of BLM administered Lands and OE LLC also acquired from its affiliate Wind Development Contract Co. its application for an additional 8,878 acres of adjacent BLM administered lands. OE LLC also has entered into an agreement with the owner of approximately 26 acres of private land near the center of the wind project area for wind monitoring. The three separate parcels are consolidated into a single 561 MW wind project in this Plan of Development.

The proposed action consists of the construction, operation, maintenance and decommissioning of wind turbine generators and associated facilities necessary to successfully generate up to 561 MW in Imperial County west of Ocotillo, California. The project will be constructed in two phases: Phase I will comprise 130 2.3 MW wind turbine generators with a total nameplate capacity of 299 MW, and Phase II will comprise 114 wind turbine generators with a total nameplate capacity of 262.2 MW (nameplate capacity is the full rated capacity of a wind turbine generator).

Surface disturbing activities may cause direct adverse impacts to paleontological resources through the damage or destruction of fossils; or loss of valuable scientific information by the disturbance of the stratigraphic context in which fossils are found. Indirect adverse impacts may be created by increased accessibility to important paleontological resources leading to looting or vandalism (BLM H-8270-1; BLM IM 2009-011). Paleo Solutions has been retained by Aspen Environmental Group to identify and analyze possible effects to significant paleontological resources within the study area for the Ocotillo Wind Express Project. The direct effects of all proposed surface disturbing activities and the indirect effects of increased public access and land tenure adjustments will be considered in the analysis. The paleontological assessment will include an initial analysis of existing data in order to determine whether further analysis will be necessary.

All paleontological work will be conducted in consultation with Carrie Simmons, BLM Archaeologist in the El Centro Field Office. The BLM Authorized Officer and/or Project Leader will also be consulted on all final paleontological resource decisions.

2. Analysis of Existing Data (*completed*)

Prior to the commencement of field survey, an analysis of existing data will determine the presence of paleontologically sensitive bedrock and younger surficial sedimentary deposits within the study area that may contain scientifically significant paleontological resources. If the background research indicates that fossil-bearing geologic units are present within the study area, a field survey will be recommended.

The analysis of existing data will be based on the Potential Fossil Yield Classification System (PFYC). It will also include a review of published (and if applicable, unpublished) literature on the paleontology of the geologic units within the Project area, a museum and agency fossil locality record search conducted at the San Diego Natural History Museum, Anza-Borrego Desert State Park (if available), and the BLM, and a review of published geologic mapping at the smallest available scale. Aerial photos with geology overlaid will be analyzed in order to determine the locations of potentially fossil-bearing rock strata and surficial sediments. The results of the background research and analysis of existing data will be included in a paleontological assessment report, and will include specific research questions and standardized items to be addressed. The parameters in the assessment will be designed to identify conditions for which a field survey will be recommended. Note that depending upon the project schedule, the results of the background research could be provided in the survey report after completion of the field survey.

If the results of the analysis of existing data analysis indicate that the Project area contains only low sensitivity geologic formations (PFYC Class 1/2), and no scientifically important fossil localities are known to occur within the Project area, the results of the research will be compiled in a paleontological assessment report, and no additional paleontological analysis will be recommended. In this instance, a standard stipulation that construction work must cease and the BLM must be notified immediately should any unexpected fossil discoveries be made by construction workers. The type of work planned for specific locations within the Project area will also be analyzed. For example, if a specific project involves weed spraying and/or minor surface activities that will not impact fossils, or if fossil-bearing rocks occur at a greater depth than the planned depth of construction disturbance, paleontological surveys and monitoring would not be necessary. Areas with moderate (PFYC Class 3) or high/very high (PFYC Class 4/5) paleontological sensitivity with surface exposures of bedrock will be recommended for inclusion in a pedestrian survey that should be completed prior to construction (BLM IM 2008-009; IM 2009-011). Where the locations of paleontologically sensitive rocks and sediments intersect with areas of proposed surface disturbance, a paleontological survey should be conducted in order to provide surface clearance for the project, and to assist with the development of construction mitigation recommendations, which could include monitoring in high sensitivity areas/geologic formations. The survey will identify resources that may be exposed on the surface, and help possibly avoid adverse impacts. Avoidance of resources is a preferred mitigation strategy if it is feasible. However, avoidance areas can only be identified by conducting a field survey. If avoidance is not feasible, surface fossils should be collected and the fossil sites included in any monitoring plan for locations where ground disturbance of paleontologically sensitive geologic units is appropriate.

Recommendations Based on Results of the Analysis of Existing Data (excerpted from confidential paleontological assessment technical report):

1) All areas mapped as PFYC Class 1 (intrusive igneous rocks) and Class 2 (Holocene alluvium and terrace deposits) are recommended for immediate paleontological clearance because these deposits have little potential for producing in-situ fossils. These deposits comprise approximately 10,134 acres of the total Project area. Note that these deposits may contain fossils at depth because deeper sediments may be Pleistocene in age. Because the thickness of the Holocene alluvium and terrace deposits is highly variable and is not precisely known, it is recommended that construction personnel working in these areas notify the BLM Authorized Officer immediately should any subsurface bones or other potential fossils be encountered.
2) Areas mapped as PFYC Class 3a, 3b, and 5 (Alverson Formation, Latrania Formation, Split Mountain Formation, Palm Spring Formation, and Older alluvium) have a moderate

or unknown to very high potential for producing scientifically important fossil remains, and should be subject to a 100% pre-construction pedestrian inventory focused on areas with good exposures (i.e. unvegetated and not covered by soil, slopewash, etc.). Based on the geologic map, these deposits comprise approximately 3,632 acres of the Project area.

3) All scientifically significant fossil localities discovered during the paleontological inventory that are located in areas that intersect Project infrastructure should be mitigated (fossils documented and collected) prior to surface disturbance. The fossils should be prepared to the point of curation housed in a BLM approved museum (meets federal DM-411 curation standards). The BLM should provide instruction as to whether fossils should be inventoried initially and collected later, or collected at the time of discovery. Note that very large fossils, or other localities that require more than one day to document and salvage, will be recommended for avoidance or additional mitigation in consultation with the BLM.
4) The results of the paleontological inventory should be detailed in a Paleontological Survey Report that that follows BLM reporting guidelines (BLM Manual and Handbook 8270-1, BLM IM 2009-011). This report should include construction mitigation recommendations based on the results of the paleontological survey. Preliminarily, construction monitoring of Project excavations in the Alverson Formation (sedimentary facies only), Split Mountain Formation, Palm Spring Formation, and Older Alluvium will be recommended based on the known potential for these rock units to contain scientifically significant fossil remains.
5) During construction and during future Project operations, the BLM Authorized Officer should be notified immediately if any fossils are encountered by construction or other Project personnel.

3. Field Survey Strategy (modified from original research design based on analysis of existing data).

In consultation with BLM, a field survey of paleontologically sensitive locations within the study area will be conducted under BLM permit CA-10-00-006P (expires 4/20/2013). The survey will occur in areas where scientifically significant fossils can be expected to occur within the boundary and immediate vicinity of the anticipated disturbance, or where the probability of encountering fossils is unknown. Conducting a survey prior to construction is desirable from a planning perspective because it provides the option of avoiding impacts to fossil localities by moving the locations of planned project infrastructure.

The field survey will be completed by two groups of paleontologists, for a total of four to five crew members. The paleontologists will complete a 100% pedestrian block survey of all potentially fossiliferous bedrock outcrops and exposures of surficial sediments that occur on PFYC Class 3, 4, or 5 formations. Areas with low sensitivity will not be surveyed. All field personnel will meet the BLM's qualification requirements as listed in Appendix A of the Guidelines for Assessment and Mitigation of Potential Impacts to Paleontological Resources (BLM H-8270-1; BLM IM 2009-011). The Paleo Solutions Principal Investigators (Geraldine Aron and Paul Murphey), and the Field Director (Scott Armstrong) will accompany the paleontological field crew (Maria Espinoza, Jennifer Kelly, Jeff Hathaway, Mark Deering, Joey Raum, Daniel Lara and Jessica Tibor) during all field survey activities. Two to three field crew members will be accompanying the Principal Investigators and Field Director at anyone time during survey. All field personnel will adhere to proper safety procedures including checking in and out the BLM, staying hydrated, emergency field contact information, and other standard safety practices.

The field survey is anticipated to take a maximum of eight working days to complete based on the analysis of existing data, which indicates that the Project area contains 3,640 acres of paleontologically sensitive geologic formations. Approximately 0.75 square miles will be surveyed per day. The survey will include documentation of the surficial geology of each quarter-quarter section surveyed. Previously recorded fossil localities are normally re-visited and re-evaluated during the course of a paleontological survey. However, the analysis of existing data has indicated that no previously recorded fossil localities occur within the project area. All new fossil localities will be stratigraphically positioned. Data will be collected using GPS receivers. Field data recorded will include types of fossils discovered, location in UTM coordinates (NAD 83 datum), field identifications (taxonomic and morphological), rock type, stratigraphic position, depositional environment and taphonomic observations. Per Charlotte T. Hunter's (BLM California State Office DPO, Archaeologist/Paleontologist/Tribal Relations) request, our field staff will georeference any rock art observed or located in the field while surveying for paleontological resources. The survey results will be documented in a final paleontological survey report that will include recommended construction mitigation measures as appropriate. The report will follow BLM guidelines (BLM H-8270-1; BLM IM 2009-011).

All fossils observed during the field survey will be recorded. All isolated scientifically significant fossils will be collected at the time of discovery. Very large fossils, or large concentrations of fossils, will be documented but left in place, and recommended for avoidance by the project if feasible. Fossils that are very poorly preserved and unidentifiable, or are otherwise considered to be non-significant, will not be collected. Following completion of the survey, all fossils collected will be prepared in Paleo Solutions' paleontological laboratory, identified, analyzed, and curated at the San Diego Natural History Museum (SDNHM). Paleo Solutions has obtained a curation agreement for this project from the SDNHM.

4. Reporting Strategy

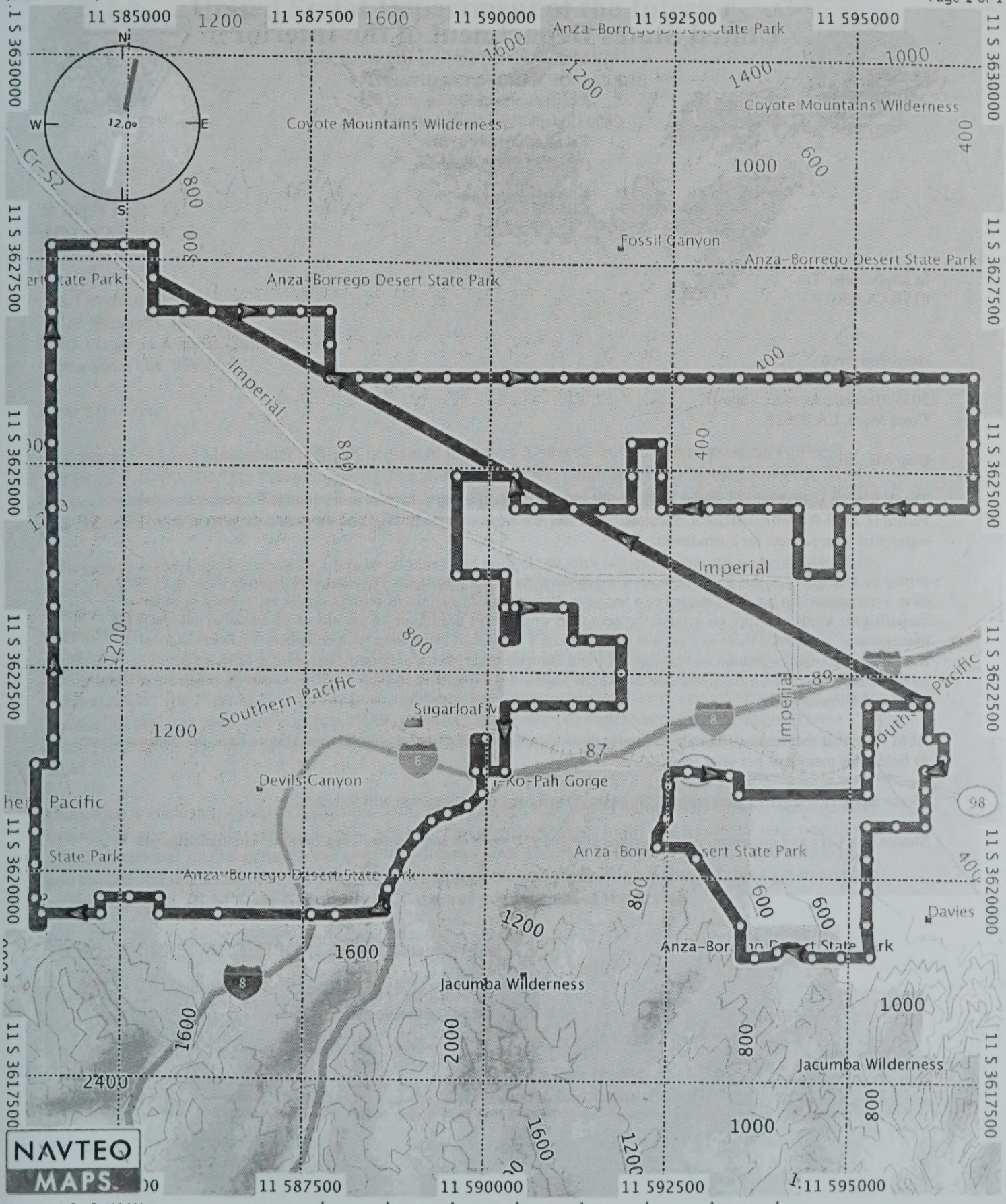
As stated above, the field survey results will be documented in a final paleontological survey report that will include recommended construction mitigation measures as appropriate (following BLM H-8270-1; BLM IM 2009-011). The report will be submitted to the BLM for agency review. BLM Locality Forms will be included in the report. All fossil localities will be plotted on a U.S.G.S 7.5' minute Topographic Quadrangle. Locality data in these reports are considered sensitive and will not be included in public documents. Because this is a relatively large paleontological project, the report and fossil curation schedule must be developed and approved by the BLM. Following agency review, a copy of the report, along with field maps and data, will be delivered along with any fossils collected (prepared to the point of identification and curation) to the San Diego Natural History Museum. The results of the final report will provide guidance for the future management of paleontological resources within the project area.

The final survey report will address the following considerations:

1) Whether adverse effects at individual fossil localities cannot be avoided.
2) Whether the adverse effects can be avoided by altering the location or scope of the project (or individual components).
3) Whether the impacts can be mitigated through development of special stipulations such as requiring on-site monitoring; mitigation to protect paleontological resources will be determined on a case-by-case basis. Monitoring may also be required as part of an overall mitigation for a project which was developed during NEPA process, or upon the discovery of paleontological resources during project activities. A monitoring plan will be in progress and completed prior to construction if monitoring

is recommended. The monitoring plan indicates the treatments recommended for the area of the proposed disturbance and must minimally address the following.

4) Whether field surveys determined the presence or absence of significant paleontological resources.
5) Whether fossil localities discovered would be excavated/removed prior to the commencement of construction. This would only be necessary for larger and more complex sites that could not be readily collected to provide paleontological clearance during the field survey.



NAVTEQ MAPS.

Topo U.S. 24K West

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Track

GARMIN.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
California State Office
2800 Cottage Way, Suite W1834
Sacramento, CA 95825
www.ca.blm.gov

December 14, 2010

In Reply Refer To:
8151(CA-930) P

Geraldine Aron
Paleo Solutions, Inc.
2035 Placentia Avenue, Suite D
Costa Mesa, CA 92627

Dear Ms. Aron:

Thank you for your correspondence of December 13, 2010, requesting personnel amendments for your Paleontology Permit (*CA-09-00-006P*). BLM professional staff has reviewed your permit file and the materials you submitted in support of your request for amendment.

It may be instructive at this juncture to review qualification requirements for Principal Investigators (PI). A PI must have a minimum of a graduate degree or a bachelor degree with 24 months of professionally supervised experience including the kinds of duties covered in the permitted work. A PI must have 16 months of professional paleontology management experience including project planning and 4 months of experience with comparable paleontological resources in similar environmental settings. A Field Director must have a bachelor's degree and 12 months professionally supervised experience or 30 months supervised experience leading up to responsibilities similar to those of a Field Director.

BLM finds that the resumes submitted support the addition of Mark Deering, Joey Raum, Daniel Lara, and Jessica Tibor as field crew members, per your request.

Please attach this letter to your permit. No revised hard copy of your permit will follow.

Should you have any questions, please call me at (916) 978-4648 or send an email to Charlotte_Hunter@blm.gov.

Sincerely,

Charlotte Hunter

Dr. Charlotte Hunter
State Archaeologist

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
California State Office
2800 Cottage Way, Suite W1834
Sacramento, CA 95825
www.ca.blm.gov

MAY 1 3 2010

In Reply Refer To:
8151 (CA930)P

Ms. Geraldine Aron
Paleo Solutions, Inc.
2035 Placentia Avenue, Suite D
Costa Mesa CA 92627

Dear Ms. Aron:

The Bureau of Land Management (BLM) is pleased to issue a 3-year Scientific Paleontological Collecting Permit (*CA-10-00-006P*) to Paleo Solutions, Inc., for use on Public Lands managed by the California BLM, as specified in your permit. This permit is issued under the authority of the Federal Land Management Policy Act (FLMPA) and the Antiquities Act of 1906. Keep a copy with you at all times in the field.

This permit authorizes the permit holders to conduct and collect paleontological resources pertaining to both scientific research and commercial projects. BLM would like to emphasize a few points. First, this permit assigns to your firm the responsibility to submit reports and other documents in a timely fashion and such submittal will be a major point of review of your firm's performance under this permit. Second, you are required to contact the appropriate Field Office to obtain a Field Use Authorization before you begin any fieldwork. Please allow the Field Office sufficient lead-time to process your application for a Field Use Authorization. The Field Office may impose additional conditions and stipulations at that time. Third, please be mindful that it is your firm's responsibility to ensure assignment of supervisory field personnel (crew chiefs) to projects that have at least 4-months local experience and who otherwise meet the standards of the BLM.

Our office is enclosing a map of California BLM Field Offices with phone numbers of cultural heritage staff (a similar map can also be viewed at http://www.ca.blm.gov/fieldoffices.html) and a copy of your permit with attached National special permit conditions. BLM draws your attention to these stipulations and encourages you to read and understand them. Please sign page 5, as indicated, and **return a copy of this signature page to the California BLM State Office within 30 days of your receipt of the permit**.

Should you have any questions, please call me at (916) 978-4648.

Sincerely,

for Dr. Charlotte Hunter
State Archaeologist

Enclosures

DI Form 1991 (Rev Sept 2004)
OMB No. 1024-0037
Exp. Date (01/31/2008)

United States Department of the Interior

PERMIT FOR PALEONTOLOGICAL INVESTIGATIONS

To conduct archeological work on Department of the Interior lands and Indian lands under the authority of:

- ☒ The Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm) and its regulations (43 CFR 7).
- ☐ The Antiquities Act of 1906 (P.L. 59-209; 34 Stat. 225, 16 U.S.C. 431-433) and its regulations (43 CFR 3).
- ☐ Supplemental regulations (25 CFR 262) pertaining to Indian lands.
- ☒ Bureau-specific statutory and/or regulatory authority: Federal Land Policy and Management Act of 1976 (Public Law 94-570), and Section 302 of Public Law 94-4579

Please use this number when referring to this permit
No.: **CA-10-00-0006P**

1. Permit issued to **Paleo Solutions Inc.**	2. Under application dated **March 24, 2010**
3. Address **2035 Placentia Ave, Suite D** **Costa Mesa, CA 92627**	4. Telephone number(s) **562.818.7713** 5. E-mail address(es) geraldine@paleosolutions.com

6. Name of Permit Administrator **Geraldine Aron** Telephone number(s): Email address(es):	7. Name of Principal Investigator(s) **Geraldine Aron, Paul Murphey** Telephone number(s): Email address(es):
8. Name of Field Director(s) authorized to carry out field projects **Geraldine Aron, Scott Armstrong, Jeff Hathaway**	Telephone number(s): Email address(es):

9. Activity authorized
Survey and Recordation

10. On lands described as follows
All lands administered by the California Desert District of the Bureau of Land Management

11. During the duration of the project From **May 1, 2010** To **April 30, 2013**

12. Name and address of the curatorial facility in which collections, records, data, photographs, and other documents resulting from work under this permit shall be deposited for permanent preservation on behalf of the United States Government.
San Diego Natural History Museum, P.O. Box 121390, San Diego, CA 92112

13. Permittee is required to observe the listed standard permit conditions and the special permit conditions attached to this permit.

14. Signature and title of approving official Daniel Morris	15. Date 5/14/10

15. Standard Permit Conditions

a. This permit is subject to all applicable provisions of 43 CFR Part 3, 43 CFR 7, and 25 CFR 262, and applicable departmental and bureau policies and procedures, which are made a part hereof.

b. The permittee and this permit are subject to all other Federal, State, and local laws and regulations applicable to the public lands and resources.

c. This permit shall not be exclusive in character, and shall not affect the ability of the land managing bureau to use, lease or permit the use of lands subject to this permit for any purpose.

d. This permit may not be assigned.

e. This permit may be suspended or terminated for breach of any condition or for management purposes at the discretion of the approving official, upon written notice.

f. This permit is issued for the term specified in 11 above.

g. Permits issued for a duration of more than one year must be reviewed annually by the agency official and the permittee.

h. The permittee shall obtain all other required permit(s) to conduct the specified project.

i. Archeological project design, literature review, development of the regional historic context framework, site evaluation, and recommendations for subsequent investigations must be developed with direct involvement of an archeologist who meets the Secretary of the Interior's Standards for Archeology and Historic Preservation; fieldwork must be generally overseen by an individual who meets the Secretary of the Interior's Standards for Archeology and Historic Preservation.

j. Permittee shall immediately request that the approving official (14. above) make a modification to accommodate any change in an essential condition of the permit, including individuals named and the nature, location, purpose, and time of authorized work, and shall without delay notify the approving official of any other changes affecting the permit or regarding information submitted as part of the application for the permit. Failure to do so may result in permit suspension or revocation.

k. Permittee may request permit extension, in writing, at any time prior to expiration of the term of the permit, specifying a limited, definite amount of time required to complete permitted work.

l. Any correspondence about this permit or work conducted under its authority must cite the permit number. Any publication of results of work conducted under the authority of this permit must cite the approving bureau and the permit number.

m. Permittee shall submit a copy of any published journal article and any published or unpublished report, paper, and manuscript resulting from the permitted work (apart from those required in items q. and s., below), to the approving official and the appropriate official of the approved curatorial facility (item 12 above).

n. Prior to beginning any fieldwork under the authority of this permit, the permittee, following the affected bureau's policies and procedures, shall contact the field office manager responsible for administering the lands involved to obtain further instructions.

o. Permittee may request a review, in writing to the official concerned, of any disputed decision regarding inclusion of specific terms and conditions or the modification, suspension, or revocation of this permit, setting out reasons for believing that the decision should be reconsidered.

p. Permittee shall not be released from requirements of this permit until all outstanding obligations have been satisfied, whether or not the term of the permit has expired. Permittee may be subject to civil penalties for violation of any term or condition of this permit.

15. Standard Permit Conditions (continued)

q. Permittee shall submit a preliminary report to the approving official within a timeframe established by the approving official, which shall be no later than 6 weeks after the completion of any episode of fieldwork, setting out what was done, how it was done, by whom, specifically where, and with what results, including maps, GPS data, an approved site form for each newly recorded archeological site, and the permittee's professional recommendations, as results require. If other than 6 weeks, the timeframe shall be specified in Special Permit Condition p. Depending on the scope, duration, and nature of the work, the approving official may require progress reports, during or after the fieldwork period or both, and as specified in Special Permit Condition r.

r. Permittee shall submit a clean, edited draft final report to the agency official for review to insure conformance with standards, guidelines, regulations, and all stipulations of the permit. The schedule for submitting the draft shall be determined by the agency official.

s. Permittee shall submit a final report to the approving official not later than 180 days after completion of fieldwork. Where a fieldwork episode involved only minor work and/or minor findings, a final report may be submitted in place of the preliminary report. If the size or nature of fieldwork merits, the approving official may authorize a longer timeframe for the submission of the final report as specified in Special Permit Condition q.

t. Two copies of the final report, a completed NTIS Report Documentation Page (SF-298), available at http://www.ntis.gov/pdf/rdpform.pdf, and a completed NADB-Reports Citation Form, available at http://www.cr.nps.gov/aad/tools/nadbform_update.doc, will be submitted to the office issuing the permit.

u. The permittee agrees to keep the specific location of sensitive resources confidential. Sensitive resources include threatened species, endangered species, and rare species, archeological sites, caves, fossil sites, minerals, commercially valuable resources, and sacred ceremonial sites.

v. Permittee shall deposit all artifacts, samples and collections, as applicable, and original or clear copies of all records, data, photographs, and other documents, resulting from work conducted under this permit, with the curatorial facility named in item 12, above, not later than 90 days after the date the final report is submitted to the approving official. Not later than 180 days after the final report is submitted, permittee shall provide the approving official with a catalog and evaluation of all materials deposited with the curatorial facility, including the facility's accession and/or catalog numbers.

w. Permittee shall provide the approving official with a confirmation that museum collections described in v. above were deposited with the approved curatorial facility, signed by an authorized curatorial facility official, stating the date materials were deposited, and the type, number and condition of the collected museum objects deposited at the facility.

x. Permittee shall not publish, without the approving official's prior permission, any locational or other identifying archeological site information that could compromise the Government's protection and management of archeological sites.

y. For excavations, permittee shall consult the OSHA excavation standards which are contained in 29 CFR §1926.650, §1926.651 and §1926.652. For questions regarding these standards contact the local area OSHA office, OSHA at 1-800-321-OSHA, or the OSHA website at http://www.osha.gov.

z. Special permit conditions attached to this permit are made a part hereof.

16. Special Permit Conditions

☒ a. Permittee shall allow the approving official and bureau field officials, or their representatives, full access to the work area specified in this permit at any time the permittee is in the field, for purposes of examining the work area and any recovered materials and related records.

☒ b. Permittee shall cease work upon discovering any human remains and shall immediately notify the approving official or bureau field official. Work in the vicinity of the discovery may not resume until the authorized official has given permission.

☒ c. Permittee shall backfill all subsurface test exposures and excavation units as soon as possible after recording the results, and shall restore them as closely as reasonable to the original contour.

☒ d. Permittee shall not use mechanized equipment in designated, proposed, or potential wilderness areas unless authorized by the agency official or a designee in additional specific conditions associated with this permit.

☒ e. Permittee shall take precautions to protect livestock, wildlife, the public, or other users of the public lands from accidental injury in any excavation unit.

☒ f. Permittee shall not conduct any flint knapping or lithic replication experiments at any archeological site, aboriginal quarry source, or non-site location that might be mistaken for an archeological site as a result of such experiments.

☒ g. Permittee shall perform the fieldwork authorized in this permit in a way that does not impede or interfere with other legitimate uses of the public lands, except when the authorized officer specifically provides otherwise.

☒ h. Permittee shall restrict vehicular activity to existing roads and trails unless the authorized officer provides otherwise.

☒ i. Permittee shall keep disturbance to the minimum area consistent with the nature and purpose of the fieldwork.

☒ j. Permittee shall not cut or otherwise damage living trees unless the authorized officer gives permission.

☒ k. Permittee shall take precautions at all times to prevent wildfire. Permittee shall be held responsible for suppression costs for any fires on public lands caused by the permittee's negligence. Permittee may not burn debris without the authorized officer's specific permission.

☒ l. Permittee shall conduct all operations in such a manner as to prevent or minimize scarring and erosion of the land, pollution of the water resources, and damage to the watershed.

☒ m. Permittee shall not disturb resource management facilities within the permit area, such as fences, reservoirs, and other improvements, without the authorized officer's approval. Where disturbance is necessary, permittee shall return the facility to its prior condition, as determined by the authorized officer.

☒ n. Permittee shall remove temporary stakes and/or flagging, which the permittee has installed, upon completion of fieldwork.

☒ o. Permittee shall clean all camp and work areas before leaving the permit area. Permittee shall take precautions to prevent littering or pollution on public lands, waterways, and adjoining properties. Refuse shall be carried out and deposited in approved disposal areas.

☐ p. Permittee shall submit the preliminary report within _____ days/weeks of completion of any episode of fieldwork..

☐ q. Permittee shall submit the final report within _____ days/weeks/months after completion of fieldwork..

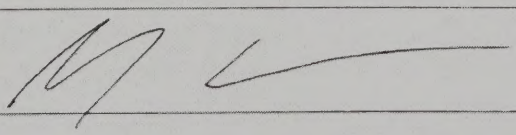
☐ r. Permittee shall submit progress reports every _____ months over the duration of the project.

☒ s. California special permit conditions are attached.

Special Permit Conditions Continuation Sheet: California Conditions

- a. Work under this permit is limited to specific service approved for each permit. This may consist of non-collection survey, limited testing to determine site content and limits or extensive testing emergency excavation and/or salvage projects. Testing/ excavation projects may be conducted under the authority of this permit only upon completion of ARPA consultation with Native American Groups and written approval from the Bureau for such work. (CARIDAPs for the purpose of the identification of archaeological resources are authorized under a FLPMA/ARPA Permit).
- b. Permittees shall verbally and subsequently in writing contact the appropriate BLM Field Manager prior to the beginning of each of his field operations (with follow-up written notification) to inform the BLM of specific work to be conducted. At this time, the BLM Field Manager may impose additional stipulation as deemed necessary to provide for the protection and management of resource values in the general site or project area.
- c. All cultural artifacts and other related materials such as notes, photographs, etc., acquired under the provisions of this permit remain the property of the United States Government and may be recalled at any time for the use of the Department of the interior or other agencies of the Federal Government. Cultural materials collected under the provisions of this permit must be curated at a repository approved by the BLM. Curation shall be at a local qualified repository, if feasible, and an approved curation facility shall be designated prior to all field projects. An itemized list of all materials with accession numbers, curated at the repository will be submitted to the State Office and to the appropriate Field Office within 180 days of the completion of individual field projects. A copy of a receipt from the curation facility must be submitted with the list or catalogue.
- d. Permittees shall acquire a primary number from the appropriate Information Center for each cultural resource documented while undertaking work authorized by this permit.
- e. The BLM Field Manager or authorized representative may require a monthly letter progress report outlining what was accomplished. This report, if required, is due by the fifth day of the following month, unless different arrangements are approved.
- f. The individual(s) in direct charge must be academically qualified and possess adequate field experience. At least two weeks prior to initiation field work, the permittees must provide the BLM Field Manager with the vitae of individuals proposed to be in direct charge if not approved at the time of permit issuance. A list of field crew members should be submitted at the same time. Only the individual(s) listed in Item No. 8 of the permit is/are authorized to be in direct charge of field work conducted under this permit.
- g. The person(s) in direct charge of field work, shall be on site at all times when work is in progress. Failure to comply with permit stipulations will result in removal of subject's name(s) from the approved list of person-in-direct-charge.
- h. Care should be exercised to avoid directly or indirectly increasing access or potential vandalism to sensitive sites.
- i. All National Permit Stipulations are binding. The authority for issuing permits in the Bureau of Land Management rests solely with the State Director as Delegated by the Secretary of the Interior and all further delegation is prohibited by Secretarial Order. No Modification of National Permit Conditions 8 or 9 or of the California Special Permit Conditions may occur except by written decision of the State Director.
- j. The Bureau of Land Management shall be cited in any report of work done under this permit, including publications such as books, news articles and scientific publications, as well as oral reports, films, television programs, and presentations in other media.

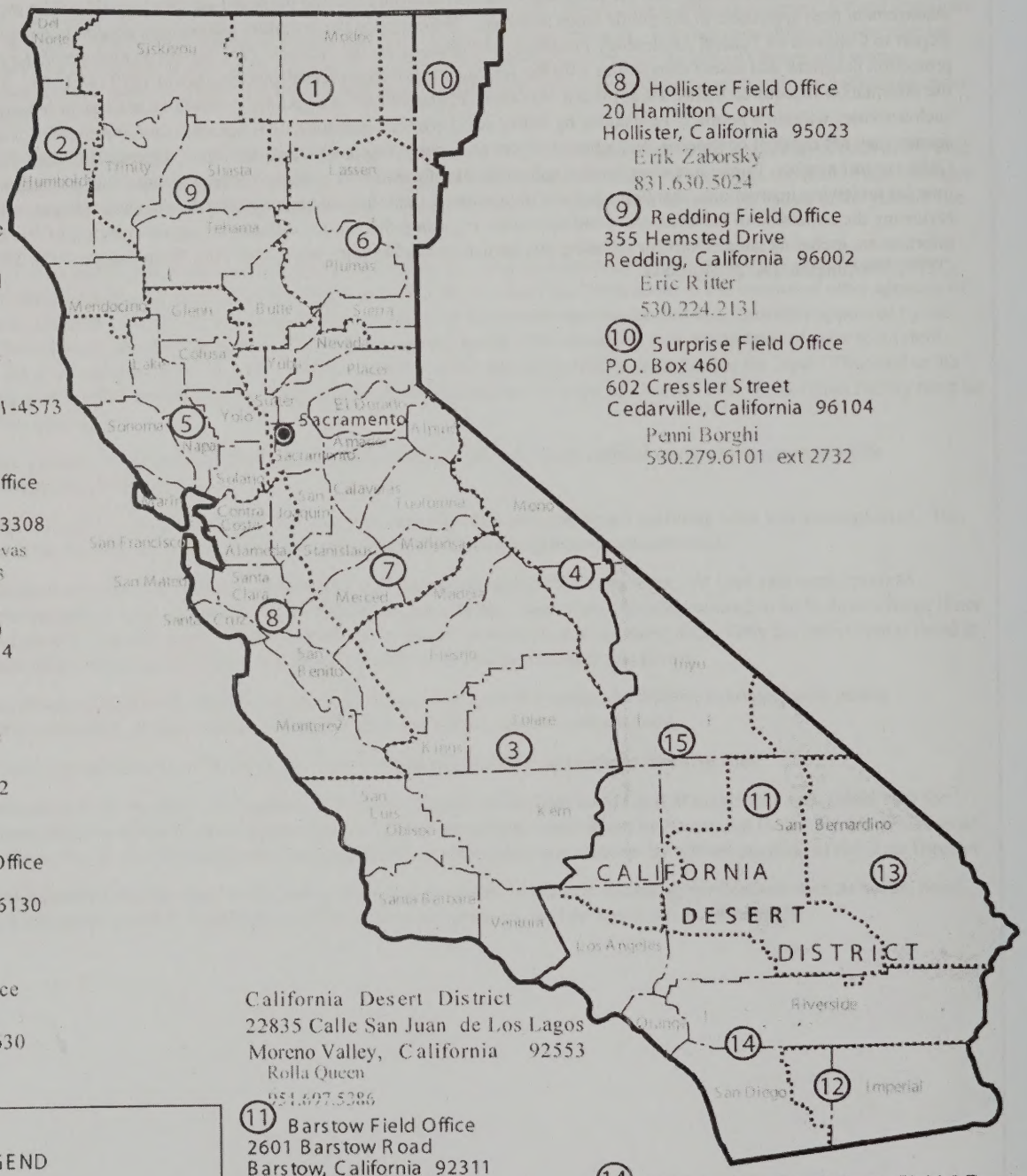
By signing below, I, the Principal Investigator, acknowledge that I have read and understand the Permit for Archeological Investigations and agree to its terms and conditions as evidenced by my signature below and initiation of work or other activities under the authority of this permit.

Signature and title:	Date:
	5/15/10

Paperwork Reduction Act and Estimated Burden Statement: This information is being collected pursuant to 16 U.S.C. 470cc and 470mm, to provide the necessary facts to enable the Federal land manager (1) to evaluate the applicant's professional qualifications and organizational capability to conduct the proposed archeological work; (2) to determine whether the proposed work would be in the public interest; (3) to verify the adequacy of arrangements for permanent curatorial preservation, as United States property, of specimens and records resulting from the proposed work; (4) to ensure that the proposed activities would not be inconsistent with any management plan applicable to the public lands involved; (5) to provide the necessary information needed to complete the Secretary's Report to Congress on Federal Archeology Programs; and (6) to allow the National Park Service to evaluate Federal archeological protection programs and assess compliance with the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470). Submission of the information is required before the applicant may enjoy the benefit of using publicly owned archeological resources. To conduct such activities without a permit is punishable by felony-level criminal penalties, civil penalties, and forfeiture of property. A federal agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a valid OMB control number. Public reporting for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Departmental Consulting Archeologist; NPS; 1849 C Street, NW (2275); Washington, DC 20240-0001.

Bureau of Land Management California Jurisdictions

California State Office, 2800 Cottage Way, Suite W-1834, Sacramento, California 95825
State Archaeologist 916.978.4648 Gina Jorgenson 916.978.4665



(1) Alturas Field Office
708 W. 12th Street
Alturas, California 96101
David Scott
530.233.7932

(2) Arcata Field Office
1695 Heindon Road
Arcata, California 95521-4573
David Johnson
707.825.2320

(3) Bakersfield Field Office
3801 Pegasus Ave.
Bakersfield, California 93308
Tamera Whitley/Kim Cuevas
661.391.6147/661.391.6123

(4) Bishop Field Office
351 Pacu Lane, Ste. 100
Bishop, California 93514
Kirk Halford
760.872.5030

(5) Ukiah Field Office
2550 N. State Street
Ukiah, California 95482
Chris Lloyd
707.468.4075

(6) Eagle Lake Field Office
2950 Riverside Drive
Susanville, California 96130
Sharynn-Marie Blood
530.257.0456

(7) Folsom Field Office
63 Natoma Street
Folsom, California 95630
James Barnes
916.985.4474

(8) Hollister Field Office
20 Hamilton Court
Hollister, California 95023
Erik Zaborsky
831.630.5024

(9) Redding Field Office
355 Hemsted Drive
Redding, California 96002
Eric Ritter
530.224.2131

(10) Surprise Field Office
P.O. Box 460
602 Cressler Street
Cedarville, California 96104
Penni Borghi
530.279.6101 ext 2732

California Desert District
22835 Calle San Juan de Los Lagos
Moreno Valley, California 92553
Rolla Queen
951.697.5286

(11) Barstow Field Office
2601 Barstow Road
Barstow, California 92311
James Shearer
760.252.6034

(12) El Centro Field Office
1661 S. 4th Street
El Centro, California 92243
Carrie Simmons
760.337.4437

(13) Needles Field Office
101 West Spikes Road
Needles, California 92363
Sally Murray 760.326.7014

(14) Palm Springs-South Coast Field Office
690 W. Garnet Avenue
North Palm Springs, California 92258
Wanda Raschkow
760.251.4824/951.697.

(15) Ridgecrest Field Office
300 S. Richmond Road
Ridgecrest, California 93555
Donald Storm
760.384.5422

LEGEND

PUBLIC LANDS

DISTRICT BOUNDARY

FIELD OFFICE BOUNDARIES

STATE OFFICE

Appendix C: Curation Agreement Letters

State of California • The Resources Agency
Arnold Schwarzenegger, *Governor*

DEPARTMENT OF PARKS AND RECREATION
Ruth Coleman, *Director*
Colorado Desert District Stout Research Center
Anza-Borrego Desert State Park
200 Palm Canyon Drive
Borrego Springs, California 92004

Geraldine Aron
President
Paleo Solutions Inc.
2035 Placentia Ave, Suite D
Costa Mesa, CA 92627

Dear Geraldine Aron,

20 January 2011

The Colorado Desert Stout Research Center (DSRC) is a professional, permanent repository for paleontologic resources collected from private, State and Federal lands. The DSRC is part of the Department of Parks and Recreation (DPR) state-wide museum system and is compliant with the DPR *Museum Collections Management Handbook* (2000) directives. Additionally, the DSRC upholds professional museum standards and is in accord with the Federal Department of the Interior's *Museum Management Handbook* D 411 (2009).

Our institution will accept and professionally curate paleontologic collections and accompanying samples, records, electronic data, maps, photographs, field notes, and other documents derived from professional standard paleontologic work conducted by Paleo Solutions Inc. This repository letter is written specifically for paleontologic materials recovered during the Ocotillo Express Wind project. The DSRC further agrees to assume permanent curatorial responsibility for such materials owned by and on behalf of the Bureau of Land Management (*Interagency Cooperative Agreement* 1994).

Sincerely,

George T. Jefferson

George T. Jefferson
Associate State Archaeologist, District Paleontologist

SAN DIEGO NATURAL HISTORY MUSEUM
BALBOA PARK - SAN DIEGO SOCIETY OF NATURAL HISTORY - ESTABLISHED 1874

28 April 2010

Ms. Geraldine Aron
Paleo Solutions, Inc.
2035 Placentia Avenue, Suite D
Costa Mesa, CA 92627

RE: Repository for Paleontological Collections

Dear Ms. Aron:

The Department of Paleontology at the San Diego Natural History Museum agrees to be the repository for paleontological specimens collected on BLM administered land by Paleo Solutions, Inc. It is my understanding that the areas covered by the requested permit include the Ocotillo Wind Express project site and the Sunrise Powerlink project alignment.

If you have any additional questions, please feel free to contact me at 619-255-0232 or tdemere@sdnhm.org.

Sincerely,

Thomas A. Deméré

Thomas A. Deméré, Ph.D.
Curator, Department of Paleontology
San Diego Natural History Museum

Appendix D: BLM Repository Receipt Form

Bureau of Land Management
(State/District/Field Office)

Address
City, State, Zip Code

BLM Verification of Collections (completed by BLM)	
BLM Official:	
Date Received:	

REPOSITORY RECEIPT FOR COLLECTIONS

Artifacts and specimens recovered from BLM-administered lands are Federal property, and must be managed in a manner consistent with Federal stewardship responsibilities for museum collections. Cultural or paleontological resource permits for collecting activities require that the permittee arrange for curation of artifacts and specimens in an appropriate repository. Collections must be deposited in a repository for curation within one year of completion of the permitted project, unless alternate arrangements have been approved by the BLM permitting official.

This Deposition of Museum Collections Confirmation and Inventory form is required as a condition of the permit and must be completed for all museum collections originating from BLM administered lands, with the associated documentation, to ensure collections are deposited in an appropriate curatorial facility. A receiving document generated by the repository may be substituted if it contains the same information as this form.

Instructions

1. All information requested on this form must be completed by the permittee and repository officials.
2. Permittees must provide an itemized inventory of the objects, lots, samples, and associated documentation to be deposited attached to this statement. The inventory must include site or locality designation, number of units per material type according to BLM and the repository standards. A complete collection includes:
   - All artifacts, specimens, and environmental materials collected with provenience data
   - All survey or excavation records and logs
   - All maps showing locations and boundaries
   - All valid photographs, negatives, and slides
   - All analysis records, and copies of all reports and publications
3. A repository official must acknowledge receipt of the collection. Before signing, the repository official should compare the inventory to the actual objects and records being deposited.
4. If the permittee and the Repository Official are the same individual, an additional Repository Official must be signatory to this form.
5. After this form has been signed by the repository official, the original form with the collection inventory must be submitted the BLM State Archaeologist by the permittee.
6. Upon submission to BLM, the BLM official may contact the repository to verify the inventory of collections deposited by the permittee.

Permittee Information

Permit Number: CA-10-00-006P Project Name and Number: BLM Ocotillo Wind Express
Permittee Name: Geraldine L. Aron
Address: 2035 Placentia Ave Suite D
City, State Zip Code: Costa Mesa, CA 92627
Telephone Number: 562-818-7713

Certification of Collection Deposition in Repository by Permittee

I, Geraldine L. Aron (Permittee) certify that Colorado Desert District Stout Research Center (name of repository) has on this date, 3/25/2011, accepted the collections of objects, lots, samples, and associated documentation described on the attached inventory.

Signature: [signature] Date: 4/7/11

Complete or Partial Deposit (check one)

x I certify that the inventory represents all materials and associated documentation from the work performed under this permit (complete deposit).

I certify that this represents a portion of the materials and associated documentation. The attached sheet lists what materials are not yet deposited, the reason they are not deposited at this time and when they are expected to be deposited (partial deposit).

Curation Facility Information

Repository Name: Anza Borrego Desert State Park, Colorado Desert District Stout Research Center
Address: 200 Palm Canyon Drive
City, State Zip Code: Borrego Springs, CA 92004
Telephone Number: (760) 767-4974
Official Authorizing Receipt (name and title): Lyndon K. Murray
Accession Number Assigned by the Repository: CDDSRC DOES NOT USE ACCESSION NUMBERS - EACH SPECIMEN CATALOGUED SEPARATELY SEE SPECIMEN CATALOGUE NUMBERS

Receipt of Collection Statement by Repository Official

I, LYNDON K. MURRAY (Repository Official) certify that the STOUT RESEARCH CENTER (name of facility) has on this date 4/7/2011, accepted the collections of objects, lots, samples and associated documentation described on the attached inventory from GERALDINE L. ARON (permittee).

Signature: [signature] Date: 07 APR 2011

Bureau of Land Management

COLLECTION INVENTORY FORM

Permit Number: CA-10-00-006P
Repository Name: Colorado Desert District Stout Research Center
Repository Accession Number:

Discipline: _____ **Archaeology**
(check one) x **Paleontology**

Site or Locality Number	Catalog Numbers or Field Specimen Numbers	Material Type	Quantity	Unit Type object, bag, cubic feet, linear feet, other (specify)	Comments
3465	V8885	Bone	1	Object/bone	20101228MER-05
3465	V8886	Bone	1	Object/bone	20101228MER-05
3466	V8887	Bone	1	Object/bone	20101228GLA-1
3466	V8888	Bone	1	Object/bone	20101228GLA-1
3466	V8889	Bone	2	Object/bone	20101228GLA-1
3466	V8890	Bone	1	Object/bone	20101228GLA-1
3466	V8891	Bone	4	Object/bone	20101228GLA-1
3466	V8892	Bone	4	Object/bone	20101228GLA-1
3466	V8893	Bone	1	Object/bone	20101228GLA-1
3467	V8894	Bone	2	Object/bone	20101229PCM-1
3467	V8895	Bone	4	Object/bone	20101229PCM-1
3467	V8896	Bone	2	Object/bone	20101229PCM-1
3467	V8897	Bone	1	Object/bone	20101229PCM-1
3467	V8898	Bone	1	Object/bone	20101229PCM-1
3467	V8899	Bone	1	Object/bone	20101229PCM-1
3467	V8900	Bone	1	Object/bone	20101229PCM-1
		TOTAL ITEMS:	16	Objects	

Appendix E: Confidential. BLM Fossil Locality Forms, Fossil Locality Maps, Fossil Locality Photos

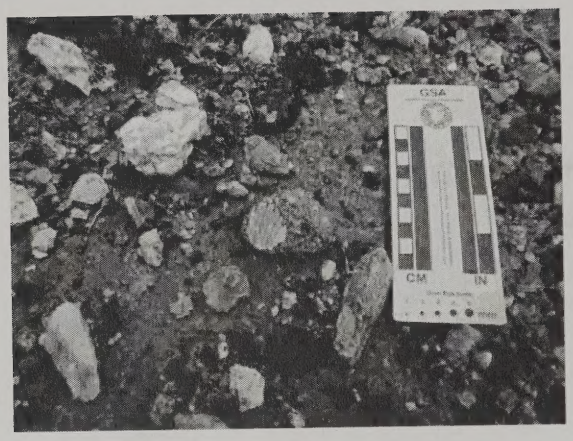


Figure 1. Closeup of 20101222MER-1, pectinidae.

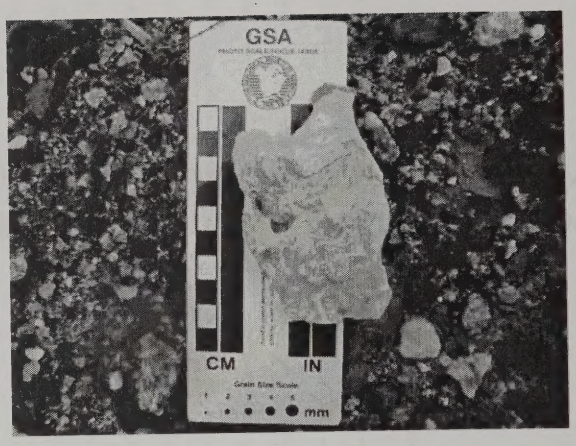


Figure 2. Closeup of 20101222MER-1 ostrea.

Figure 3. Overview of 20101222MER-1 locality, view to the east.

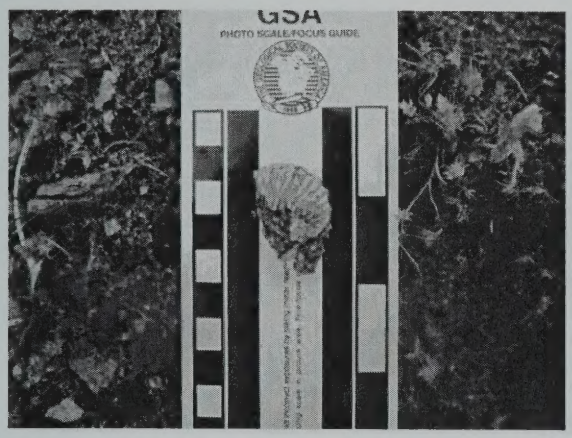


Figure 1. Closeup of 20101222MER-2 pecten shell.

Figure 2. Closeup of 20101222MER-2 ostrea shell.

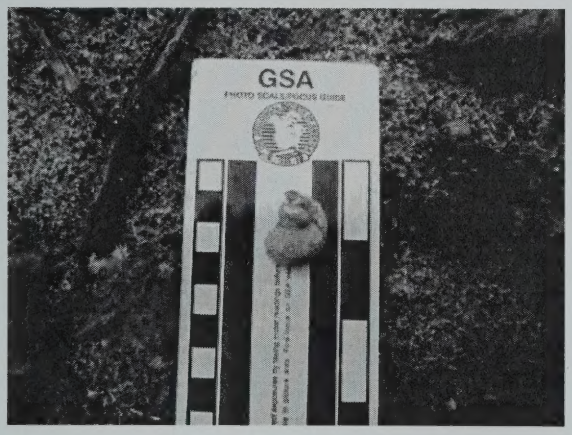


Figure 3. Closeup of 20101222MER-2 gastropod interior mold.

Figure 4. Overview of localities 20101222MER-1 and 20101222MER-2, facing east.

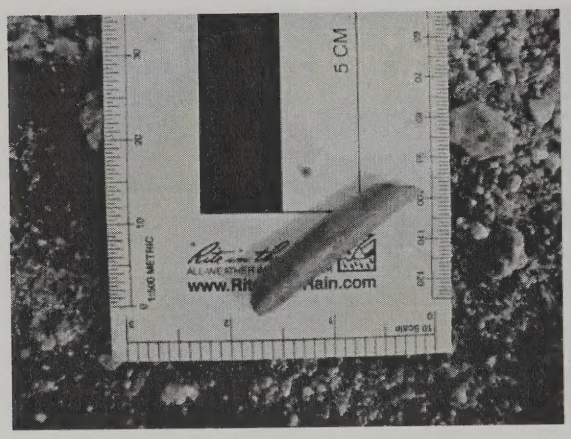


Figure 1. Closeup of 20101222MER-3, long bone shaft fragment.

Figure 2. Overview of locality 20101222MER-3, facing southwest.

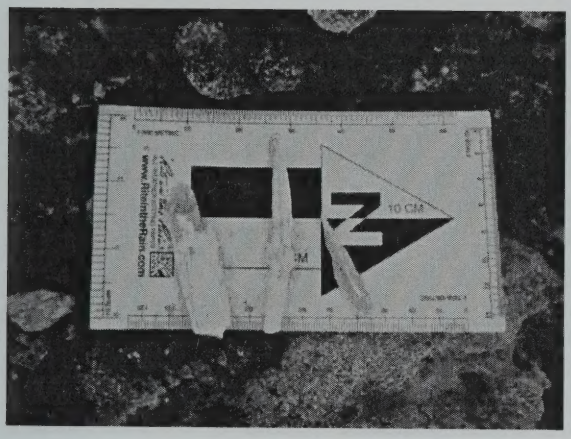


Figure 1. Closeup of 20101222MER-4, mammalian long bone shaft fragments.

Figure 2. Overview of site 20101222MER-4, view southwest.

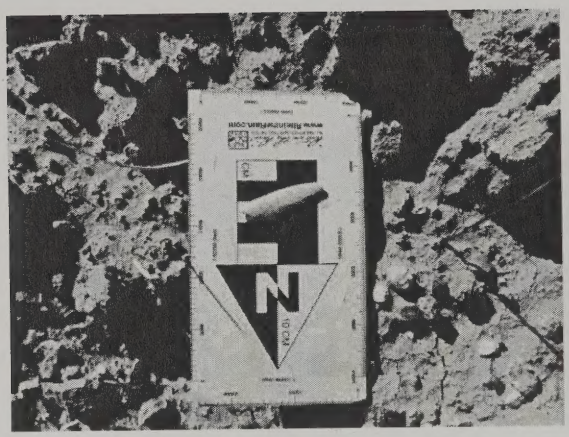


Figure 1. Closeup of 20101227JH-1 mammalian bone fragment.

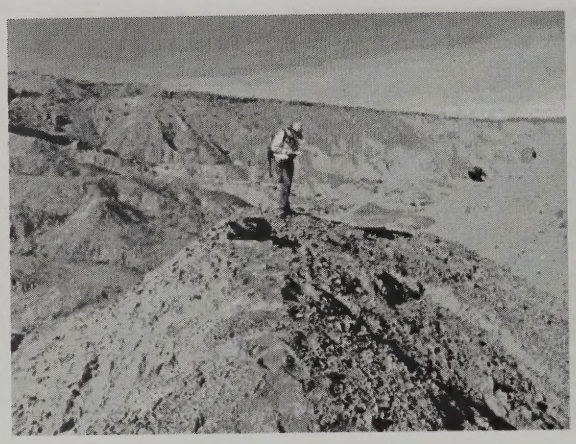


Figure 2. Overview of site 20101227JH-1, view west.

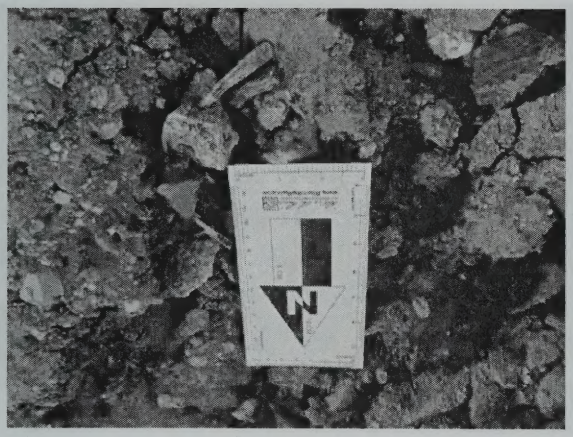


Figure 1. Closeup of 20101227JH-2, 2 mammalian long bone shaft fragments.

Figure 2. Overview of site 20201227JH-2, view east.

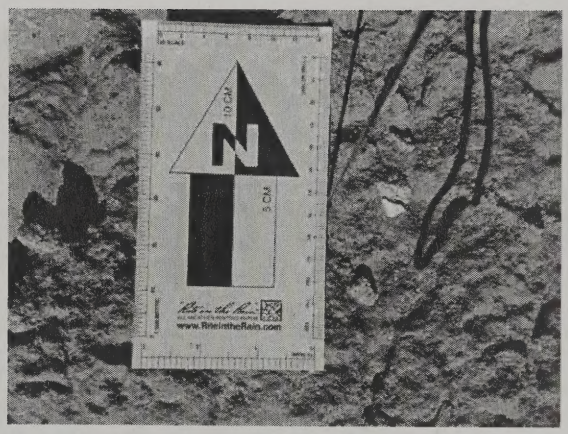


Figure 1. Closeup of 20101227JH-3, testudines carapace fragment.

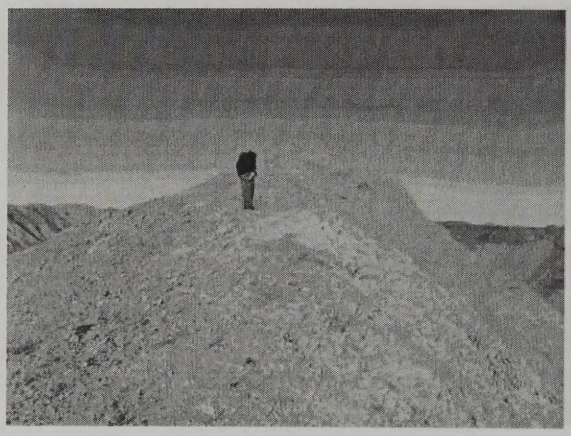


Figure 2. Overview of site 20201227JH-3, view north.

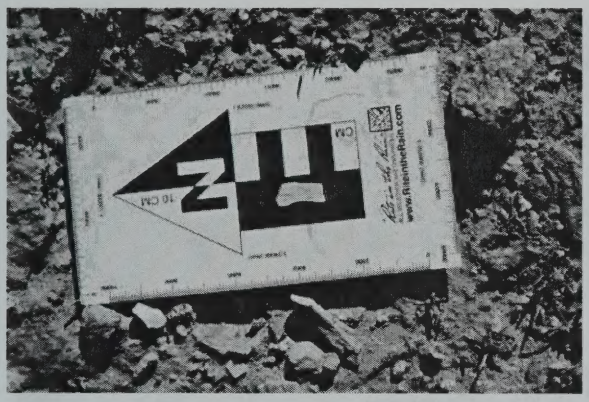


Figure 1. Closeup of 20101227MER-1 testudines carapace fragment.

Figure 2. Overview of locality 20101227MER-1, view northwest.

Figure 1. Closeup of 20101227MER-2, aves bones.

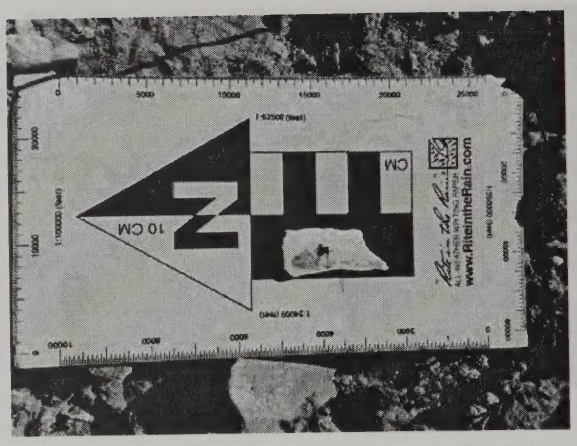


Figure 2. Closeup of 20101227MER-2, mammalian bone fragments.

Figure 3. Overview of locality 20101227MER-2, facing east.

Figure 1. Overview of 20101227MER-3 locality, facing southwest.

Figure 1. Closeup of 20101227SRA-1, 2 mammalian long bone shaft fragments.

Figure 2. Overview of 20101227SRA-1, view to the west.

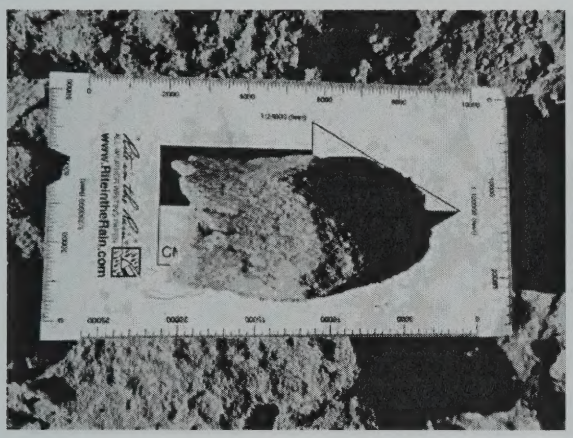


Figure 1. Closeup of 20101227SRA-2, 1 mammalian bone fragment.

Figure 2. Overview of 20101227SRA-2, view to the east.

Figure 1. Closeup of 20101227GLA-1, 1mammalian bone fragments.

Figure 2. Overview of 20101227GLA-1, view to the northwest.

Figure 1. Closeup of testudines costal fragment from site 20101227GLA-2a.

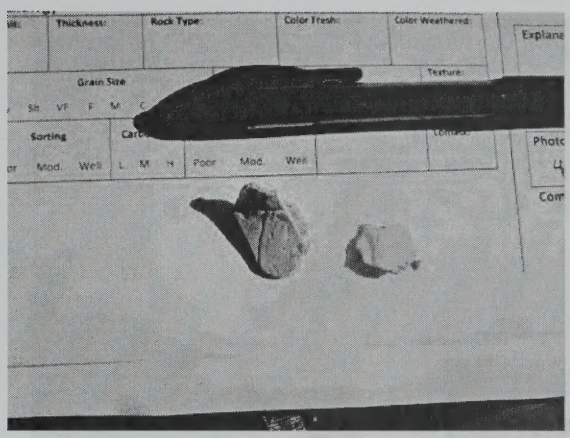


Figure 2. Closeup of testudinae shell fragments from site 20101227GLA-2a.

Figure 3. Overview of site 20101227GLA-2a, facing south.

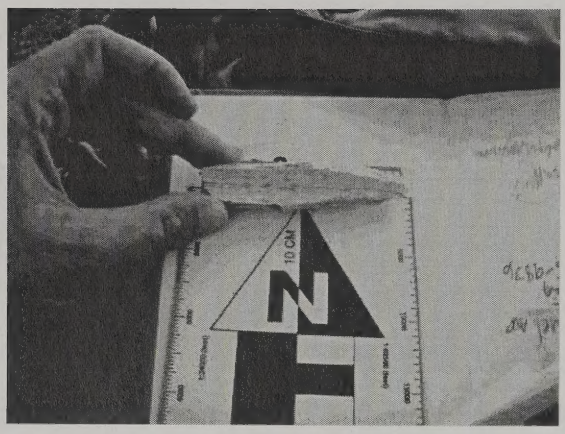


Figure 1. Closeup of mammalian bone fragment from site 20101227GLA-2b.

Figure 1. Overview of site 20101228MRD-1, view to the west-northwest.

Figure 1. Closeup of lagomorpha bone fragments from locality 20101228MRD-2.

Figure 2. Overview of locality 20101228MRD-02, facing east-northeast.

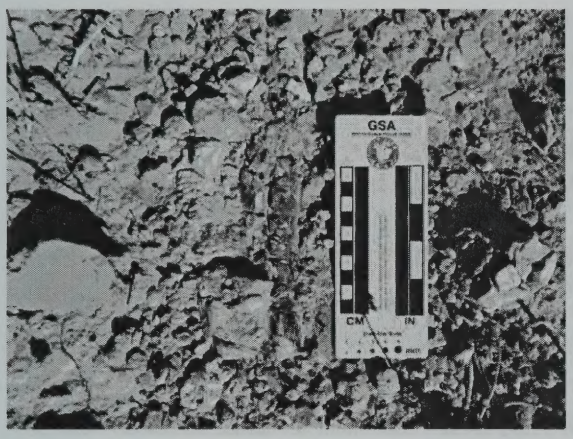


Figure 1. Closeup of mammalian humerus fragments from locality 20101228PCM-1.

Figure 2. Overview of locality 20101228PCM-1, facing east-northeast.

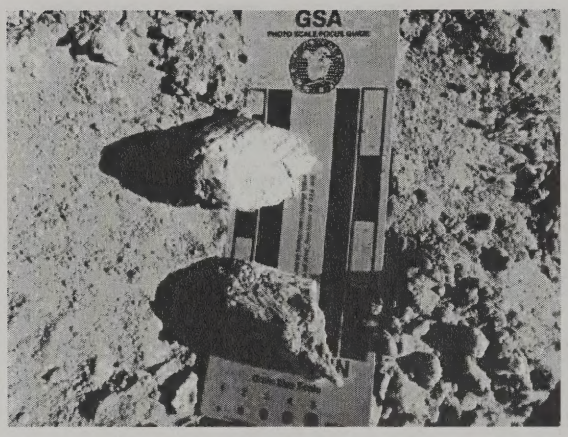


Figure 1. Closeup view of 2 mammalian vertebral cemtrum from locality 20101228MER-01.

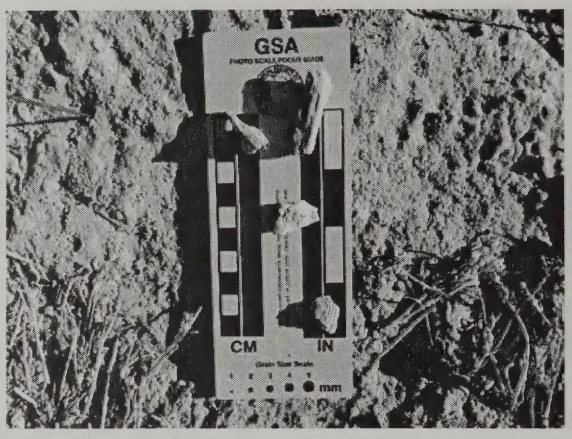


Figure 2. Closeup of testudines shell fragments and unidentified bone from locality 20101228MER-1.

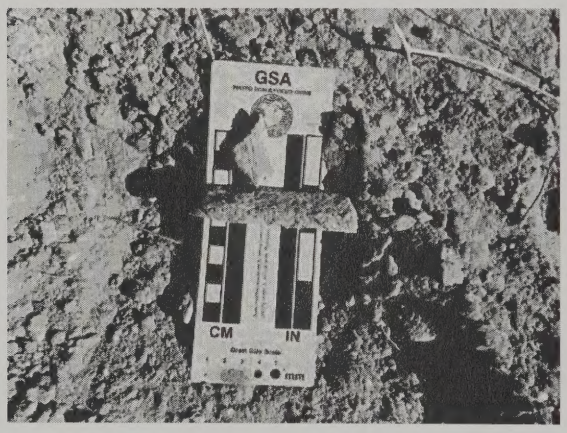


Figure 3. Closeup of mammalian bone fragments from locality 20101228MER-1.

Figure 4. Overview of locality 20101228MER-1, facing southeast.

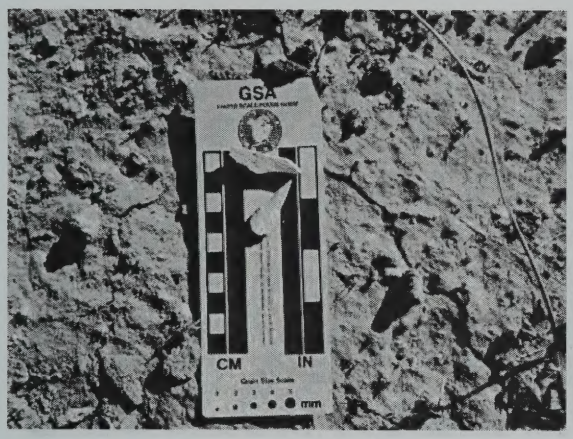


Figure 1. Closeup view of 2 testudines carapace fragments from locality 20101228MER-2.

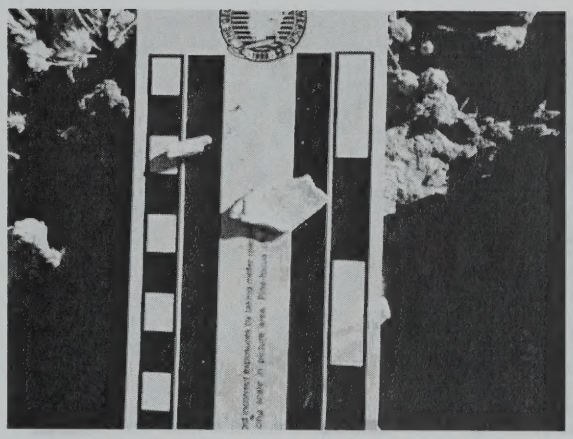


Figure 2. Closeup testudines shell fragment and unidentified mammalian bone from locality 20101228MER-2.

Figure 3. Overview of locality 20101228MER-2, facing west-southwest.

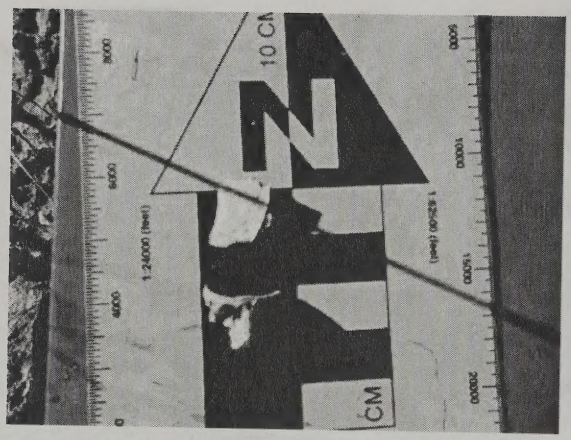


Figure 1. Closeup of osteichthyes vertebra and unidentified mammalian bone fragment from locality 20101228MER-3. .

Figure 2. Overview of locality 20101228MER-2, facing east-northeast.

Figure 1. Closeup view of artiodactylae distal 1st phalanx, from locality 20101228MER-5.

Figure 2. Closeup view of artiodactylae distal 1st phalanx, from locality 20101228MER-5.

Figure 3. Closeup view of unfused vertebral centrum,from locality 20101228MER-5.

Figure 4. Overview of locality 20101228MER-5, view north-northwest.

Figure 1. Closeup view, mammalian phalanx from locality 20101228GLA-1..

Figure 2. Closeup view of mammalian tarsal bone from locality 20101228GLA-1.

Figure 3. Closeup view of unfused vertebral centrum,from locality 20101228GLA-1.

Figure 4. Overview of locality 20101228GLA-1, view north.

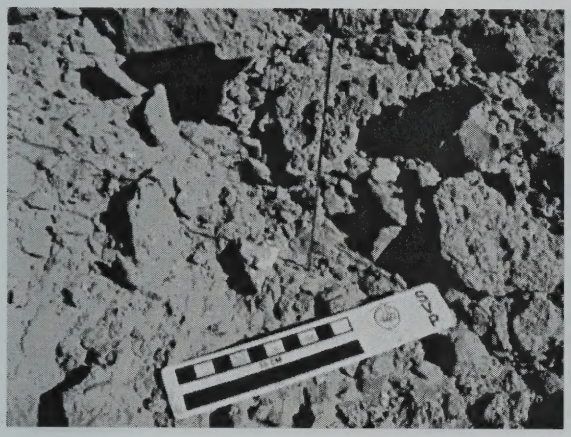


Figure 1. Closeup view, mammalian humerus fragment from locality 20101228GLA-3.

Figure 2. Closeup view of mammalian ischium fragment from locality 20101228GLA-3.

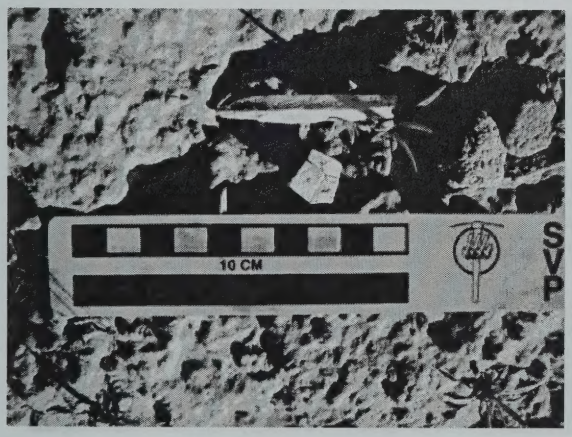


Figure 3. Closeup view of marginal carapace fragment from testudines,from locality 20101228GLA-3.

Figure 4. Overview of locality 20101228GLA-3, view southwest.

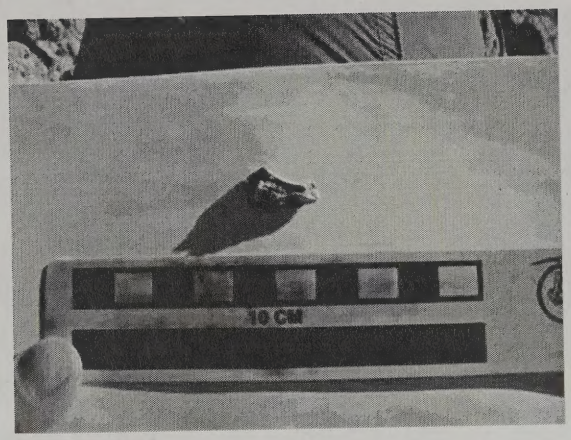


Figure 1. Closeup view, artiodactylae tooth fragment from locality 20101228GLA-9.

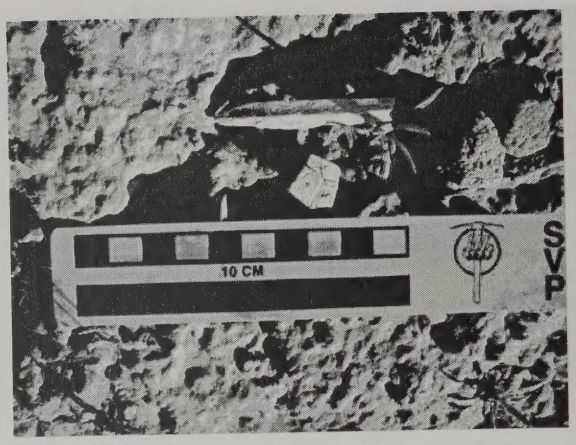


Figure 2. Closeup view of a testudinae carapace fragment with preserved sutures, from locality 20101228GLA-9.

Figure 3. Closeup view of mammalian bone fragments,from locality 20101228GLA-9.

Figure 4. Overview of locality 20101228GLA-9, view down.

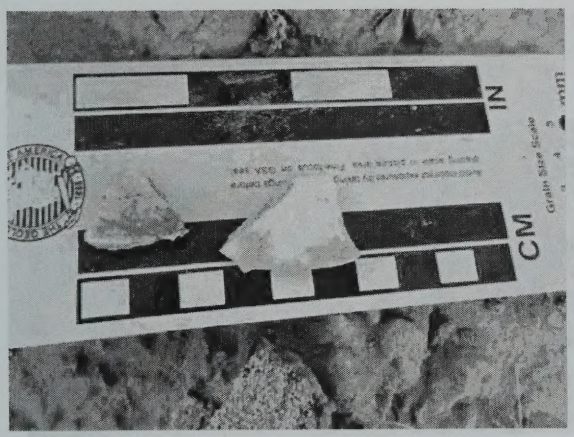


Figure 1. Closeup view, two partial plastron scutes of testudinae from locality 20101229MER-1.

Figure 2. Overview of locality 20201229MER-1, view north.

Figure 1. Closeup view, two partial plastron fragments of testudinae, and 7 mammalian bone fragments from locality 20101229PCM-1.

Figure 2. Overview of locality 20201229PCM-1, view northeast.

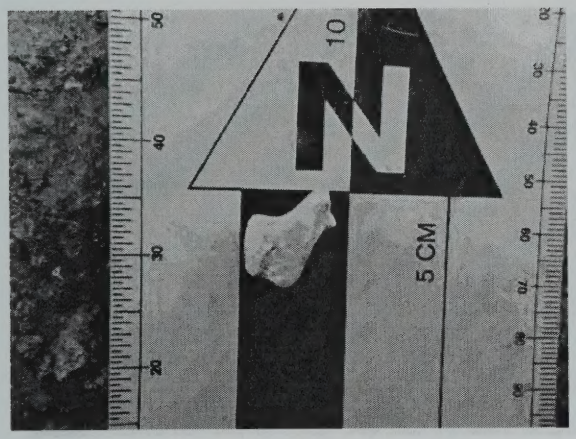


Figure 1. Closeup view, mammalian femur fragment from locality 20101229PCM-2.

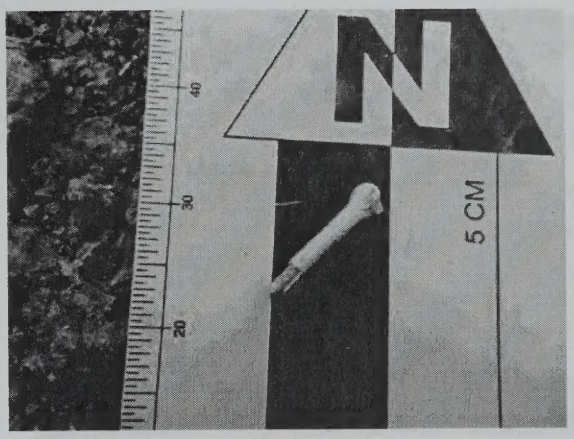


Figure 2. Closeup view of aves undetermined bone fragment from locality 20101229PCM-2.

Figure 3. Closeup view of fragment from testudines,from locality 20101229PCM-2.

Figure 4. Overview of locality 20201229PCM-2, view southeast.

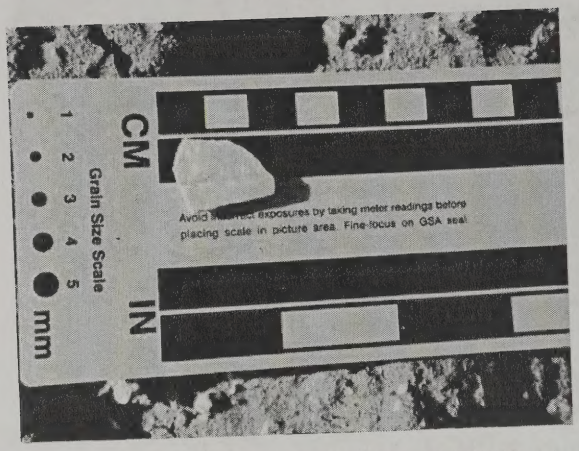


Figure 1. Closeup view, testudines carapace fragment fragment from locality 20101229JH-1.

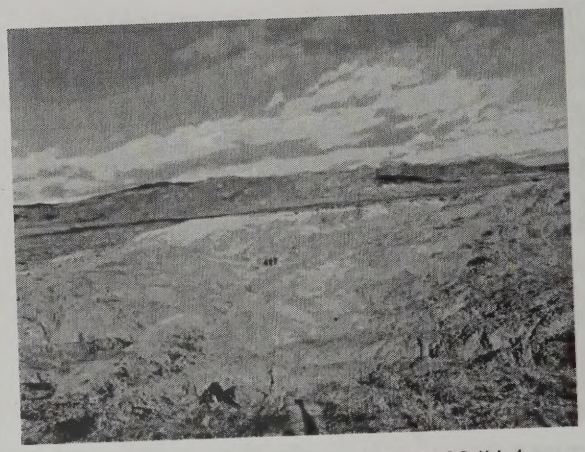


Figure 2. Overview of locality 20101229JH-1, facing north.

Figure 1. Closeup view, mammalian bone fragments from locality 20101229JH-2.

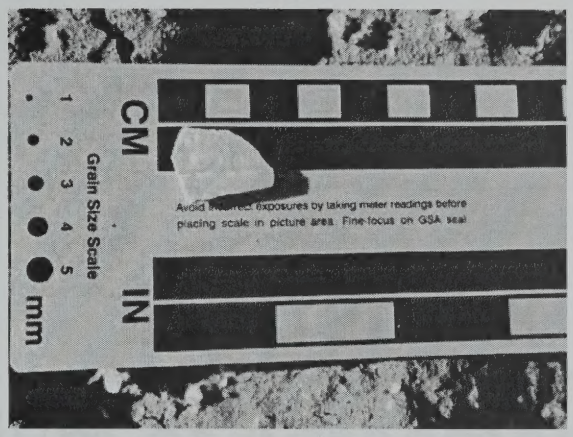


Figure 2. Closeup view of testudines carapace fragment from locality 20101229JH-2.

Figure 3. Overview of locality 20101229JH-2, facing north.

Appendix R

Memorandum of Agreement

Appendix R

Memorandum of Agreement

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MEMORANDUM OF AGREEMENT AMONG THE BUREAU OF LAND MANAGEMENT-CALIFORNIA, THE UNITED STATES ARMY CORPS OF ENGINEERS, OCOTILLO EXPRESS LLC, THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION REGARDING THE OCOTILLO EXPRESS WIND ENERGY PROJECT IMPERIAL COUNTY, CALIFORNIA

WHEREAS, Ocotillo Express LLC (Applicant), has applied for a right-of-way (ROW) grant on public lands managed by the Bureau of Land Management (BLM) and has submitted a plan of development to construct, operate and maintain a wind turbine electrical energy generation plant on federal and non-federal lands, including construction of access and maintenance roads, meteorological testing towers, a substation and energy collecting system, laydown and staging areas, and support facilities and infrastructure (hereinafter, the "Project"); and

WHEREAS, the BLM has determined that the issuance of a ROW (proposed federal action) to the Applicant in accordance with the Federal Land Policy and Management Act (FLPMA) (Pub. L. 940-579; 43 U.S.C 1701) and authorization of the Project is an undertaking subject to Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. § 470(f), and its implementing regulations under 36 C.F.R. Part 800 (2004); and

WHEREAS, the United States Army Corps of Engineers (COE) may also have Section 106 responsibilities since it may issue a Department of the Army (DA) permit pursuant to Section 404 of the Clean Water Act (proposed federal action) for discharges of dredged or fill material into jurisdictional waters of the United States associated with the Project, which is an undertaking subject to Section 106 of the NHPA, and therefore has participated in this consultation and is a Signatory to this Agreement; and

WHEREAS, the BLM is the lead federal agency for the undertaking as provided at 36 C.F.R. § 800.2(a)(2) fulfilling the collective responsibilities for complying with Section 106 on behalf of itself and COE, and the BLM shall be responsible for managing historic properties within the area of potential effects (APE); and

WHEREAS, the BLM has consulted with the California State Historic Preservation Officer (SHPO) pursuant to 36 CFR Part 800 of the regulations implementing Section 106 of the NHPA; and

WHEREAS, in accordance with the regulations at 36 C.F.R. § 800.6(a)(1) BLM has notified the Advisory Council on Historic Preservation (ACHP) regarding the effects of alternatives of the undertaking on historic properties and has invited the ACHP to participate in consultation to resolve the potential effects on historic properties, and as per their letter dated

December XX, 2011, the ACHP is participating in this consultation and is a Signatory to this Agreement (see 36 C.F.R. § 800.6(b)(2), "Resolution with Council Participation); and

WHEREAS, the County of Imperial may authorize a portion of the Project facilities on private land and has certain responsibilities under State laws and regulations to take into account and mitigate the impacts on properties eligible for or included on the California Register of Historical Resources and has participated in consultation and is invited to participate in this Agreement as a Concurring Party; and

WHEREAS, the BLM and the County of Imperial have prepared the *Draft Plan Amendment and Draft Environmental Impact Statement/Environmental Impact Report for the Ocotillo Wind Energy Facility (2011)* to identify the Project alternatives for purposes of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), and have comparatively examined the relative effects of the alternatives on known historic properties; and

WHEREAS, the Applicant has participated in this consultation per 36 C.F.R. § 800.2(c)(4), will be the entity to whom the BLM may grant a ROW, and has the responsibility for carrying out the specific terms of this Agreement under the oversight of the BLM, and is an Invited Signatory to this Agreement; and

WHEREAS, the BLM has authorized the Applicant to conduct specific identification efforts for the undertaking including a review of the existing literature and records and cultural resources surveys to identify historic properties that might be located within the APE; and

WHEREAS, the reports *Draft Archaeological Survey Report for the Ocotillo Wind Energy Project, Imperial County, CA*, prepared by Tierra Environmental Services, October 2011, and the *Draft Historical Resources Evaluation and Impact Analysis for the Ocotillo Express Wind Energy Project, Imperial County, CA*, prepared by Scott Moomjian, November 2011 present the results of identification and evaluation efforts for archaeological and historical resources; and

WHEREAS, the Viejas Band of Kumeyaay Indians have identified a Traditional Cultural Property (TCP) and cultural landscape that has cultural and religious value to their Tribe and other tribes, and has been submitted as a sacred site under Executive Order 13007,and the undertaking falls within the boundaries of the TCP identified by the Tribe; and

WHEREAS, through Section 106 consultation with consulting parties and government-to-government consultation with Indian tribes, the BLM has determined that the historic property, CA-IMP-6988 known as the "Spoke Wheel Geoglyph", is locally significant and eligible for the National Register of Historic Places (NRHP) under Criterion A for its association with historical patterns or events significant to the cultural traditions of the community. The Spoke Wheel Geoglyph was previously determined eligible and listed on the National Register of Historic Places (NRHP) under Criteria C and D because of its distinctive construction and the likelihood of providing important information. For the purposes of project management the BLM assumes the portion of the TCP (and associated cultural resources) as identified by the

tribes within the Project area is eligible for the NRHP. The BLM also recognizes the TCP and its associated cultural resources as identified by the tribes as having cultural and religious value to the tribes; and

WHEREAS, through Section 106 consultation and government-to-government consultation with Indian tribes, the BLM has determined that all build alternatives under consideration for implementation would have an adverse effect on the following historic properties: CA-IMP-6988 known as the "Spoke Wheel Geoglyph", the portion of the TCP that lies within the APE as identified by tribes, and the cultural resources that the tribes have identified that are related to the TCP to which Indian tribes attach religious and/or cultural significance. The BLM has consulted with the SHPO pursuant to 36 C.F.R. § 800.6 of the regulations implementing Section 106 of the NHPA and has concluded that the undertaking shall have an adverse effect; and

WHEREAS, the BLM intends to manage all known archaeological sites within the APE as eligible for inclusion on the NRHP for project management purposes; and

WHEREAS, pursuant to 36 C.F.R. § 800.2(c)(2)(ii) and Executive Order 13175, the BLM is responsible for government-to-government consultation with federally recognized Indian tribes and is the lead federal agency for all tribal consultation and coordination. The BLM has formally notified and invited federally recognized tribes (Tribes), including the Barona Band of Diegueno Indians, Campo Band of Mission Indians, Cocopah Indian Tribe, Ewiiaapaayp Band of Kumeyaay Indians, Fort Yuma Quechan Indian Tribe, Jamul Indian Village, La Posta Band of Kumeyaay Indians, Manzanita Band of Kumeyaay Indians, Mesa Grande Band of Mission Indians, San Pasqual Band of Diegueno Indians, Santa Ysabel Band of Diegueno Indians, Sycuan Band of Kumeyaay Nation, Torres-Martinez Desert Cahuilla Indians, and Viejas Band of Kumeyaay Indians to consult on the undertaking and participate in this Agreement as a Concurring Party; and

WHEREAS, the BLM has invited the non-federally recognized tribe of the Kwaaymii Laguna Band of Indians (Tribal Organization) to consult on the undertaking and participate in this Agreement as a Concurring Party; and

WHEREAS, the Campo Band of Mission Indians, Fort Yuma Quechan Indian Tribe, Manzanita Band of Kumeyaay Indians, San Pasqual Band of Diegueno Indians, Viejas Band of Kumeyaay Indians, Kwaaymii Laguna Band of Indians, and the Southern California Tribal Chairman's Association, have proposed that the BLM select a no project alternative due to effects identified by the Tribes on the TCP and cultural landscape; and

WHEREAS, the BLM shall continue to consult in a government-to-government manner with the Tribes throughout the implementation of this Agreement regarding effects to historic properties to which they attach religious and cultural significance. BLM will carry out its responsibilities to consult with Tribes that request such consultation with the further understanding that, notwithstanding any decision by these Tribes to decline concurrence, BLM shall continue to consult with these Tribes throughout the implementation of this Agreement; and

NOW, THEREFORE, the BLM, COE, SHPO, and ACHP (Signatories), and the Applicant (Invited Signatories), agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the adverse effect of the undertaking on historic properties, resolve such adverse effects through the process set forth in this Agreement, and provide the ACHP with a reasonable opportunity to comment in compliance with Section 106.

STIPULATIONS

The BLM shall ensure that the following measures are implemented:

I. DEFINITIONS

The definitions found at 36 C.F.R. § 800.16 and in Appendix A shall apply throughout this Agreement.

II. AREA OF POTENTIAL EFFECTS

The area of potential effects (APE) is described and depicted in Appendix B to this Agreement. Appendix B as set forth hereunder may be modified through consultation among the parties to this Agreement without amending the Agreement. The APE, as currently defined, encompasses an area sufficient to accommodate all of the proposed and alternative project components under consideration as of the date of execution of this Agreement. If it is determined in the future that the undertaking may directly or indirectly affect historic properties located outside the currently defined APE, then the BLM, in consultation with SHPO and pursuant to 36 C.F.R. § 800.4(a)(1), shall determine and document modifications to the APE using the following process:

a) Consulting parties to this Agreement may propose that the APE established herein be modified. If the Signatories and Invited Signatories decide that such modification requires an amendment of the Agreement, the BLM shall follow the procedures in Stipulation X.

b) If the Signatories and Invited Signatories agree to the proposal, then the BLM will prepare a description and a map of the modification to which the Signatories and Invited Signatories agree. The BLM will keep copies of the description and the map on file for its administrative record and distribute copies of each to the other consulting parties within 30 days of the day upon which agreement was reached.

c) Where modification to the APE adds a new geographic area, the BLM shall take the steps necessary to identify, evaluate and take into account the effects of the undertaking on historic properties in the new geographic area in accordance with this Agreement.

III. AVOIDANCE, PROTECTIVE MEASURES AND TREATMENT PLANS

The BLM will continue to monitor mitigation measures and treatments that would avoid and minimize adverse effects to identified historic properties including the TCP identified by several Tribes. Through continuing Section 106 and government-to-government consultation, design for the undertaking has been proposed to reduce the number and/or location of wind turbines from 155 to 112. The reduction and relocation of wind turbines was undertaken, in part, to address impacts to the TCP and cultural landscape as identified by several Tribes. Additional wind turbines were removed or relocated to assure that there would be no effects within the physical boundaries of the archaeological and historical resources identified for the undertaking. Turbines were also removed from the original layout to protect cremation locations.

a) Where archaeological resources are avoided, the BLM will implement the management or protective measures identified in Table 1 of Appendix C and the following:

   i. Archaeological sites that are protected from physical impacts, but are within 150 feet of proposed construction activities, will be identified and labeled by archaeological and Native American monitors as Environmentally Sensitive Areas (ESAs). This includes archaeological sites determined eligible for inclusion in the NRHP and sites that have not been formally evaluated, but are being treated as eligible and avoided for project management purposes.
   ii. The ESAs will be designated by marking the boundaries of sites with appropriate buffer zones using temporary fencing or other easily recognizable boundary defining materials.
      (1) These ESAs will be shown on the engineering plans for the Project as off-limits to construction activities.
      (2) Once established, an ESA will define areas where construction activities cannot occur to prevent damage to historic properties within the designated ESA.
      (3) Construction work areas will also be clearly defined using temporary fencing or other easily recognizable boundary defining materials.
   iii. ESAs will be identified and established prior to initiation of ground disturbing activities and will be maintained and monitored for the duration of the work effort in the ESA vicinity.

b) Approval of any alternative other than the No Action/No Project alternative would adversely affect the historic property, CA-IMP-6988, referred to as the Spoke-Wheel Geoglyph and the TCP and its associated cultural resources as identified by the Tribes. The BLM will mitigate the adverse effects and values of cultural and religious importance to the Tribes as follows:

   i. The BLM shall respect the Tribes' rights to express their traditional cultural values, including those associated with their religions, and their right to access federally managed lands to conduct cultural and religious practices, as variously specified in E.O. 13007, the Religious Freedom Act (RFA), and the American Indian Religious Freedom Act (AIRFA). The BLM shall consult with the Tribes, Applicant and other agencies to develop a plan to assure Tribal access to areas within the APE for traditional religious or cultural purposes. Access shall be consistent with applicable laws, regulations and agreements governing the federal property within the APE and

may not impede the undertaking. A Tribal Access Plan shall be completed upon request or within two years after signing of the ROD.

ii. The BLM shall develop a historic properties treatment plan (HPTP) in consultation with consulting parties to this Agreement. The Applicant will be responsible for implementing all provisions of the HPTP.

(1) The HPTP shall be finalized by the by the date of the Record of Decision (ROD). The BLM shall submit the HPTP to consulting parties for review. A consulting party may provide any comments directly to SHPO with a copy to the BLM within the 30-day comment period. The BLM will forward to the other Signatories and Invited Signatories all comments regarding the HPTP received during the comment period. The BLM shall submit the revised HPTP to all consulting parties for a final, 15 day review period. BLM will consider any timely comments in finalizing the HPTP. The final HPTP will be made Appendix D to this Agreement.

(2) Amendments to the HPTP shall not require an amendment to the Agreement.

iii. The HPTP will finalize and provide expanded detail on mitigation measures to resolve adverse effects. The Applicant will implement the following mitigation measures in accordance with the stipulations of the final HPTP:

(1) The HPTP will include mitigation measures that will address the values important to the traditional use of the Spoke-Wheel Geoglyph and its relationship to the larger TCP, other related sites and the cultural landscape as described by the Tribes. The mitigations measures developed shall include, but are not limited-to:

a. Visual values associated with the environmental/cultural setting and traditional use of the historic property.
b. Audible values important to the traditional use of the property.
c. Providing for access to the property.
d. Mitigations that might be implemented through coordination or scheduling of traditional use of the property with on-going Project activities.
e. Development of treatments/mitigations for the physical protection and stabilization of the Spoke-Wheel Geoglyph.
f. Mandatory cultural sensitivity training for all Applicants staff and contractors during construction and long term operation associated with this Project.

(2) The Applicant will provide funding for the following measures:

a. An ethnographic study to further document the tribal values of the historic properties within the Project Area that are considered of religious or cultural significance by Indian tribes and tribal organizations. The study will explore how these resources fit into the larger TCP and cultural landscape as identified by Tribes and document and identify the boundaries of the larger TCP and its potential eligibility to the NRHP; and if eligible, a formal

nomination to the NRHP shall be prepared.

b. Synthesis study of existing data to explore the potential for one or more archaeological districts using a regional approach and the latest GIS technology; and if district(s) are identified, or have elements that are contributing to existing districts, formal NRHP nomination forms shall be prepared.

c. Prehistoric trails continuation study.

d. Support and enhance public education and interpretation programs at a museum for the interpretation of Native American uses of the area for a better understanding by the public.

e. Professional training of a representative from each Tribe in curation management.

f. Monitoring training for tribal monitors.

g. Video documentation of the traditional songs associated with the Project area.

h. Support for existing or new language preservation initiatives for the Tribes.

(3) The BLM and the Applicant, in consultation with Tribes and the appropriate land owner(s) and within the limits of agency authority, will identify and implement resource protection measures during the period of construction, such as fencing, gating, and law enforcement patrols, to stabilize and/or protect cultural resources within the vicinity of the APE during the construction. Where continuing resource protection measures are considered appropriate after the period of construction, such measures will be developed as provided in Stipulation IV(c).

iv. Should the undertaking be approved by the BLM, the HPTP will be implemented after the ROW is granted by the BLM and the DA permit is issued by the COE, and prior to the issuance of a Notice to Proceed for construction in those portions of the undertaking addressed by fieldwork related to the terms of the HPTP.

v. Within thirty (30) days after the BLM has determined that all work required by HPTP has been completed, the BLM shall notify and submit a summary report to the consulting parties. Within twelve (12) months after BLM has determined that all work required by HPTP has been completed, or pursuant to an alternative schedule required by any HPTP implementing the requirements of this Agreement, the Applicant will submit a written draft technical report to the BLM that documents the results of implementing the HPTP. The BLM will provide the draft technical report to consulting parties for review as provided in Stipulation VII(a).

vi. Copies of the final technical report documenting the results of implementing the requirements of the HPTP will be distributed by BLM to the consulting parties and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center.

IV. MONITORING

a) Archaeological Monitoring

i. The Applicant, in consultation with the other consulting parties to this Agreement, shall develop a comprehensive archaeological monitoring plan. A comprehensive archaeological monitoring plan that has been approved by the Signatories and Invited Signatories shall take precedence over those stipulations provided below. A draft comprehensive archaeological monitoring plan shall be incorporated into the plan for post-review discoveries and unanticipated effects and will be attached as Appendix F to this Agreement. In the absence of a comprehensive archaeological monitoring plan, Paragraphs 1 – 4 of this stipulation shall apply.

(1) The Applicant shall ensure that archaeological monitors and, to the extent practicable, tribal monitors, will be on site during construction to observe all construction or other ground disturbing activities for any facilities, roads or other project components related to the undertaking near ESAs and in other areas designated for full-time monitoring, as detailed in Stipulation III, Appendix C and/or Appendix F.

(2) The Applicant shall ensure that archaeological monitors will meet the standards specified in Stipulation VIII(a), will be approved and permitted by the BLM, will be familiar with the types of historic and prehistoric archaeological resources that may occur in the APE, and will be directly supervised by a principal archaeologist (PA).

(3) The Applicant shall ensure that the PA will submit bi-weekly documentation of archaeological monitoring activities to the BLM by email. Documentation will include the location of archaeological monitoring activities for the reporting time period, as well as a description of any archaeological resources identified and any actions taken. The PA will prepare a monthly field monitoring verification report with the compiled monitoring observations, results, and actions taken for submission and approval to the BLM. The BLM will provide copies of biweekly and monthly archaeological monitoring reports to the consulting parties, unless otherwise directed by a consulting party.

(4) Upon completion of all archaeological monitoring tasks and requirements implemented pursuant to this Agreement, the Applicant shall ensure that the PA will submit within three months a final monitoring report to the BLM for review and approval. The final monitoring report will describe the monitoring program and its findings and results, and present a detailed professional description, analysis, and evaluation of any cultural resources that were encountered and evaluated during construction. The BLM will provide a copy of the monitoring report to the consulting parties.

b) Tribal Participation Plan

i. To facilitate continued tribal consultation for this undertaking, the Applicant in consultation with the BLM, and interested Tribes may develop and implement a tribal participation plan. This plan will afford representatives designated by Tribes (tribal cultural consultants) the opportunity to monitor and be on site during all construction activities to observe grading, trenching or ground disturbing activities for facilities, roads or other activities near ESAs and in other areas designated for monitoring as detailed in Appendix C and/or F.

ii. The BLM shall continue to consult with Tribes and Tribal Organizations on implementation of the project and all shall be eligible to participate in the development of a tribal participation plan whether they elect to concur in the Agreement or not.

(1) In consultation with the BLM, the Applicant will contact and identify Tribes who want to participate in the development and implementation of the plan.
(2) The Applicant will develop a draft framework for the tribal participation plan and submit it to the BLM and the participating Tribes for their review and comment.
(3) The tribal participation plan will describe the role of all parties in the program, specify the terms, expectations, notifications, reports, training, or deliverables to be provided, including all documentation requirements. The plan will include a specific procedure to be followed in the event that a tribal cultural consultant is not provided or is not available.
(4) Tribal cultural consultants will be individuals designated by the Tribes and will report to the PA.
(5) The tribal participation plan will be finalized and implemented prior to the start of ground-disturbing activities in areas designated for monitoring and consistent with the provisions of Stipulation IX (Implementation of the Undertaking).

c) Long Term Management Plan

i. The Applicant, in consultation with the other consulting parties to this Agreement, will establish and fund a Long Term Management Plan (LTMP) for the post-construction archaeological monitoring, and condition assessment of sites in the APE which could be affected by on-going operations and maintenance activities, and law enforcement patrols as provided in Stipulation III(b)(ii)(3). The Applicant shall submit a draft LTMP to the BLM within 9 months from the date of the issuance of the Notice to Proceed for the undertaking. The BLM will submit the LTMP to the consulting parties for review following the provisions of Stipulation VII(a). The LTMP will be made Appendix E to this Agreement.

V. POST-REVIEW DISCOVERIES AND UNANTICIPATED EFFECTS

The Applicant, in consultation with the other consulting parties to this Agreement, shall develop a comprehensive plan to manage post-review discoveries and unanticipated effects pursuant to 36 C.F.R. § 800.13(a). It shall be attached as Appendix F to this Agreement.

a) If human remains and/or associated funerary objects compose all or part of the discovery, then the BLM shall follow the process described in Stipulation VI.

b) The BLM at its discretion, but in consultation with SHPO, may treat any discovered property as eligible for inclusion in the NRHP for project management purposes pursuant to 36 C.F.R. § 800.13(c).

VI. TREATMENT OF HUMAN REMAINS OF NATIVE AMERICAN ORIGIN

a) The BLM shall ensure that any Native American burials and related items discovered on BLM administered lands during implementation of the terms of the Agreement will be treated respectfully and in accordance with the requirements of the Native American Graves Protection and Repatriation Act (NAGPRA) (Pub. L. 101-601) and the Plan of Action (POA) outlined in Appendix G if needed.

b) The BLM shall ensure that Native American burials and related cultural items on non-federal lands are treated in accordance with the applicable requirements of the California Public Resources Code at Sections 5097.98 and 5097.991, and of the California Health and Human Safety Code at Section 7050.5(c) and the POA in Appendix G.

c) The primary goal will be to avoid and protect newly encountered burials and related cultural items and leave them in-place.

VII. COMMUNICATION AND REPORTING

a) BLM shall submit all documents relating to the Agreement to the consulting parties in complete but draft form for review. Consulting parties will be afforded 45 days following receipt of a draft document to submit written comments to BLM unless otherwise mutually agreed to by the consulting parties. The BLM will provide consulting parties with written documentation indicating whether and how the document will be modified in response to comments. Unless consulting parties object to the revisions in writing to the BLM within 30 days following receipt of the revised document, BLM may finalize the document.

i. If a consulting party objects to the revisions during the comment period, the BLM will consult with the objecting party for no more than 30 days to resolve the objection. If the objection is resolved, the BLM will notify consulting parties of the resolution and may revise and finalize the document. If the objection cannot be resolved, the BLM shall follow the procedures in Stipulation XI(c).

ii. The BLM will provide a copy of the final document to the consulting parties.

b) The BLM shall prepare a letter report on a yearly schedule summarizing the fulfillment of the stipulations contained within this Agreement. The report will be submitted to all consulting parties to this Agreement by December 31, 2013, for the initial reporting period and every year thereafter for the duration of this Agreement.

i. The implementation and operation of this Agreement shall be evaluated on an annual basis by the parties. This evaluation, to be conducted after the receipt of the BLM letter report, may include in-person meetings or conference calls among these parties, and may provide suggestions for modifications or amendments.

ii. During the construction phase of the undertaking, the consulting parties will meet annually between January and March to discuss the fulfillment of the stipulations contained within this Agreement.

c) To the extent consistent with the National Historic Preservation Act, Section 304, and the Archaeological Resources Protection Act, Section 9(a), cultural resources data from BLM-managed lands will be treated as confidential by all consulting parties and Tribes and is not to be released to any entity or individual not a party to this agreement. Duplication or distribution of cultural resource data from BLM-managed lands by any consulting party requires written authorization from the BLM El Centro Field Manager. Confidentiality concerns for properties that have traditional religious and cultural importance to the Tribes will be respected and will be protected to the extent allowed by law.

VIII. ADMINISTRATIVE STANDARDS

a) PROFESSIONAL QUALIFICATION STANDARDS. All actions prescribed by this Agreement that involve the identification, evaluation, analysis, recordation, treatment, monitoring, and disposition of historic properties and that involve the reporting and documentation of such actions in the form of reports, forms or other records, shall be carried out by or under the direct supervision of a person or persons meeting, at a minimum, the Secretary of the Interior's Professional Qualifications Standards (PQS), as appropriate (48 Fed. Reg. 44739 dated September 29, 1983). However, nothing in this Stipulation may be interpreted to preclude any party qualified under the terms of this paragraph from using the services of persons who do not meet the PQS, so long as the work of such persons is supervised by someone who meets the PQS. Indian tribes have the sole authority to certify and approve tribal cultural consultants who may participate in activities in support of implementation of this Agreement.

b) DOCUMENTATION STANDARDS. Reporting on and documenting the actions cited in this Agreement shall conform to every reasonable extent with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 Fed Reg. 44716-40 dated September 29, 1983), as well as, the BLM 8100 Manual, the California Office of Historic Preservation's Preservation Planning Bulletin Number 4(a) December 1989, Archaeological Resource Management Reports (ARMR): Recommended Contents and Format (ARMR Guidelines) for the Preparation and Review

of Archaeological Reports, and any specific and applicable county or local requirements or report formats.

c) CURATION STANDARDS. On BLM-administered land, all records and materials resulting from the actions required by this Agreement shall be curated in accordance with 36 C.F.R. Part 79, and the provisions of the NAGPRA, 43 C.F.R. Part 10, as applicable. To the extent permitted under Sections 5097.98 and 5097.991 of the California Public Resources Code, the materials and records resulting from the actions required by this Agreement for private lands shall be curated in accordance with 36 C.F.R. Part 79. The BLM will seek to have the materials retrieved from private lands donated through a written donation agreement.

IX. IMPLEMENTATION OF THE UNDERTAKING

a) The BLM may authorize construction activities, including but not limited to those listed below, to proceed in specific geographic areas where there would be no physical effects to historic properties; where an archaeological monitoring and post-review discovery process or plan is in place per Stipulation IV and V. Such construction activities may include:

i. demarcation, set up, and use of staging areas for construction of the undertaking,
ii. conduct of geotechnical boring investigations or other geophysical and engineering activities, and
iii. grading, constructing buildings, collection system installation, and installing wind turbines.
iv. construction of transmission towers

b) Initiation of any construction activities on federal lands shall not occur until after the BLM issues the Record of Decision, ROW grant, and Notice(s) to Proceed. Construction shall not occur in waters of the United States on or off federal lands until the COE issues the DA permit.

X. AMENDMENTS TO THE AGREEMENT

This Agreement may be amended only upon written agreement of the Signatories and Invited Signatories.

a) Upon receipt of a request to amend this Agreement, the BLM will immediately notify the other consulting parties and initiate a 30 day period to consult on the proposed amendment, whereupon all parties shall consult to consider such amendments.

b) If agreement to the amendment cannot be reached within the 30 day period, resolution of the issue may proceed by following the dispute resolution process in Stipulation XI.

c) Amendments to this Agreement shall take effect on the dates that they are fully executed by the Signatories and Invited Signatories.

d) Modifications, additions, or deletions to the appendices made as a result of continuing consultation among the consulting parties do not require the Agreement to be amended.

e) The terms of this Agreement are a condition of the ROD and the ROW grant that the BLM may issue and are binding on the Applicant. For purposes of this Agreement, changes in the corporate name of the Applicant or reassignment of the ROW to a subsidiary company or other entity may be authorized by the BLM and does not require the Agreement to be amended.

XI. DISPUTE RESOLUTION

a) Should the Signatories or Invited Signatories object at any time to the manner in which the terms of this Agreement are implemented, the BLM will immediately notify the other Signatories and Invited Signatories and consult for no more than 30 days to resolve the objection.

b) If the objection can be resolved within the consultation period, the BLM may authorize the disputed action to proceed in accordance with the terms of such resolution.

c) If the objection cannot be resolved through such consultation, the BLM will forward all documentation relevant to the objection to the ACHP with copies to the consulting parties to the Agreement. Any comments provided by the ACHP within 30 days after its receipt of all relevant documentation will be taken into account by the BLM in reaching a final decision regarding the objection. The BLM will notify consulting parties in writing of its final decision within 14 days after it is rendered.

d) The BLM's responsibility to carry out all other actions under this Agreement that are not the subject of the objection will remain unchanged.

e) At any time during implementation of the terms of this Agreement, should an objection pertaining to the Agreement be raised by a Concurring Party or a member of the interested public, the BLM shall immediately notify the consulting parties, consult with the SHPO about the objection, and take the objection into account. The other consulting parties may comment on the objection to the BLM. The BLM shall consult with the objecting party for no more than 30 days. Within 14 days following closure of consultation, the BLM will render a final decision regarding the objection and proceed accordingly after notifying all parties of its decision in writing. In reaching its final decision, the BLM will take into account all comments from the parties regarding the objection.

XII. TERMINATION

a) If any Signatory or Invited Signatory to this Agreement determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to amend this Agreement in accordance with Stipulation X above. If within sixty (60) days

resolution regarding an amendment has not been reached, a Signatory or Invited Signatory may terminate the Agreement upon 10 days' written notification to the other Signatories and Invited Signatories. Following written notification, the terminating Signatory or Invited Signatory will inform the Concurring Parties and Tribes.

b) If the Agreement is terminated, and prior to work continuing on the undertaking, the BLM and COE shall either (a) execute a new Agreement pursuant to 36 C.F.R. § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 C.F.R. 800.7. Each party shall notify the other parties to the Agreement as to the course of action that it will pursue.

XIII. ADDITION/WITHDRAWAL OF PARTIES TO/FROM THE AGREEMENT

a) Should conditions of the undertaking change such that other federal agencies, state agencies, Indian tribes, tribal organizations or other organizations or individuals not already party to this Agreement request in writing to participate, the BLM will notify the consulting parties and consider the request to participate in the Agreement. Should the BLM agree to the request to participate, the Agreement shall be amended following the procedures in Stipulation X.

b) In the event that the Applicant applies for additional federal funding or other federal approvals, such funding or approving agency may comply with Section 106 by agreeing in writing to the terms of this Agreement and notifying and consulting with SHPO and ACHP. Any necessary modifications will be considered in accordance with Stipulation X.

c) Should a Concurring Party determine that its participation in this Agreement is no longer warranted, the party may withdraw from participation by informing the BLM. The BLM shall inform the other parties to this Agreement of the withdrawal. Withdrawal of a Concurring Party to the Agreement does not require an amendment of the Agreement.

XIV. SOVEREIGN IMMUNITY

a) The Tribes do not waive their sovereign immunity by entering into this MOA and each fully retains all immunities and defenses provided by law with respect to any action based on or occurring as a result of the MOA.

XV. DURATION OF THIS AGREEMENT

a) This Agreement will expire if construction has not been initiated and the BLM ROW grant expires or is withdrawn, or the stipulations of this Agreement have not been initiated, within thirty (30) years from the date of execution. Prior to such time, the BLM may consult with the other Signatories and Invited Signatories to reconsider the terms of the Agreement and amend it in accordance with Stipulation X above.

b) Unless the Agreement is terminated pursuant to Stipulation XII, another agreement executed for the undertaking supersedes it, or the undertaking itself has been terminated,

this Agreement will remain in full force and effect for the term of the ROW or until BLM, in consultation with the other Signatories and Invited Signatories, determines that implementation of all aspects of the undertaking has been completed and that all terms of this have been fulfilled in a satisfactory manner. The effective period of this Agreement may be extended as provided in Stipulation X. Upon a determination by BLM that implementation of all aspects of the undertaking have been completed and that all terms of this Agreement have been fulfilled in a satisfactory manner, BLM will notify the parties to this Agreement in writing of the agency's determination. This Agreement will terminate and have no further force or effect 30 days after BLM so notifies the consulting parties to this Agreement, unless BLM retracts its determination before the end of that period.

XVI. EFFECTIVE DATE

a) This Agreement and any amendments shall take effect on the date that it has been fully executed by the Signatories.

b) Execution and implementation of this Agreement is evidence that the BLM and the COE have taken into account the effect of the undertaking on historic properties, afforded the ACHP a reasonable opportunity to comment, and that the BLM, and the COE have satisfied their responsibilities under Section 106. The BLM shall be responsible for managing historic properties within the APE for the undertaking pursuant to the NHPA. The Signatories and Invited Signatories to this Agreement represent that they have the authority to sign for and bind the entities on behalf of whom they sign.

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SIGNATORY PARTIES

U.S. BUREAU OF LAND MANAGEMENT

BY: _____ DATE: _____

Margaret L. Goodro
Field Manager, El Centro Field Office

U.S. ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT

BY: _____ DATE: _____

David J. Castanon
Chief, Regulatory Division

CALIFORNIA STATE HISTORIC PRESERVATION OFFICE

BY: _____ DATE: _____

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY: _____ DATE: _____

John M. Fowler
Executive Director

DRAFT

INVITED SIGNATORY PARTIES

OCOTILLO EXPRESS LLC

DRAFT

INVITED SIGNATORY PARTY

OCOTILLO EXPRESS LLC

BY: _____ DATE: _____

TITLE: _____

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PARTIES INVITED TO CONCUR IN THE AGREEMENT

BARONA BAND OF DIEGUENO INDIANS
CAMPO BAND OF MISSION INDIANS
COCOPAH INDIAN TRIBE
EWIIAAPAAYP BAND OF KUMEYAAY INDIANS
FORT YUMA QUECHAN INDIAN TRIBE
JAMUL INDIAN VILLAGE
KWAAYMII LAGUNA BAND OF INDIANS
LA POSTA BAND OF KUMEYAAY INDIANS
MANZANITA BAND OF KUMEYAAY INDIANS
MESA GRANDE BAND OF MISSION INDIANS
SAN PASQUAL BAND OF DIEGUENO INDIANS
SANTA YSABEL BAND OF DIEGUENO INDIANS
SYCUAN BAND OF KUMEYAAY NATION
TORRES-MARTINEZ DESERT CAHUILLA INDIANS
VIEJAS BAND OF KUMEYAAY INDIANS
COUNTY OF IMPERIAL

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APPENDICES

A. Definitions
B. Area of Potential Effect
C. Table Summary of Eligibility and Management Recommendations for Archaeological Sites
D. Historic Properties Treatment Plan
E. Long Term Management Plan
F. Plan for Archaeological Monitoring, Post-Review Discovery, and Unanticipated Effects
G. NAGPRA Plan of Action

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APPENDIX A - DEFINITIONS

a) ***Applicant***. Refers to Ocotillo Express LLC, and to the same organization in the event of a change of the name of the LLC, provided the Signatories and Invited Signatories are notified in writing of the name change.

b) ***Area of Potential Effect.*** The APE is defined as the total geographic area or areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties per 36 C.F.R. 800.16(d). The APE is influenced by the scale and nature of an undertaking and includes those areas which could be affected by an undertaking prior to, during and after construction.

c) ***Concurring Parties***. Collectively refers to parties (not Signatories or Invited Signatories) with a demonstrated interest in the undertaking, who agree, through their signature, with the terms of this Agreement. Concurring Parties may propose amendments to this Agreement.

d) ***Cultural Resource.*** A cultural resource is an object or definite location of human activity, occupation, use, or significance identifiable through field inventory, historical documentation, or oral evidence. Cultural resources are prehistoric, historic, archaeological, or architectural sites, structures, buildings, places, or objects and locations of traditional cultural or religious importance to specified social and/or culture groups. Cultural resources include the entire spectrum of objects and places, from artifacts to cultural landscapes, without regard to eligibility for inclusion on the National Register of Historic Places (NRHP) or California Register of Historical Resources (CRHR).

e) ***Consulting Parties.*** Collectively refers to the Signatories, Invited Signatories and Concurring Parties who have signed this Agreement.

f) ***Historic Properties.*** Properties (cultural resources) that are included in, or eligible for inclusion in, the NRHP maintained by the Secretary of the Interior and per the NRHP eligibility criteria at 36 C.F.R.60.4 and may include any prehistoric or historic district, site, building, structure, traditional cultural property or object. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meet the NRHP criteria. The term "eligible for inclusion on the NRHP" refers both to properties formally determined as such in accordance with regulations of the Secretary of the Interior and all other properties that meet the NRHP criteria.

g) ***Historical Resources.*** Historical resources are cultural resources that meet the criteria for listing on the CRHR as provided at California Code of Regulations Title 14, Chapter 11.5, Section 4850 and may include, but are not limited to, any object, building, structure, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California.

h) ***Invited Signatories.*** Invited Signatories are parties that have specific responsibilities as defined in this Agreement. Those Invited Signatories who sign this Agreement have the same rights with regard to seeking amendment or termination of this Agreement as the Signatory Parties, but whose signatures are not required for execution of the Agreement. The Invited Signatories to this Agreement are the DOE and the Applicant.

i) ***Lands Administered by the U.S. Department of Interior, Bureau of Land Management*** (BLM) means any federal lands under the administrative authority of the BLM.

j) ***Signatories.*** Signatories are parties that have the sole authority to execute, amend or terminate this Agreement. Signatories to this Agreement are the BLM, COE, SHPO, and ACHP.

k) ***Traditional Cultural Property.*** A traditional cultural property is defined generally as a property that is important to a living group or community because of its association with cultural practices or beliefs that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. It is a place, such as a traditional gathering area, prayer site, or sacred/ceremonial location that may figure in important community traditions. These places may or may not contain features, artifacts, or physical evidence, and are usually identified through consultation. A traditional cultural property may be eligible for inclusion in the NRHP and the CRHR.

l) ***Tribes.*** The federally recognized Indian tribes that the BLM is consulting with on this undertaking.

m) ***Tribal Organization.*** A non-federally recognized Indian tribe or Native American organization that the BLM is consulting with on this undertaking.

n) ***Undertaking.*** Collectively refers to all projects, activities, or programs funded in whole or in part under the direct or indirect jurisdiction of the federal agencies (BLM, COE) that are party to this Agreement, including those carried out by or on behalf of the federal agency; those carried out by federal financial assistance; and those requiring a federal permit, license, or approval.

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APPENDIX B-1: AREA OF POTENTIAL EFFECT

The APE means the geographic area or areas within which an Undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an Undertaking and may be different for different kinds of effects caused by the Undertaking ((36 CFR §800.l6 (d)). Adverse effects on historic properties include, but are not limited to: physical destruction or alteration of a property or introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features (36 CFR §800.5(a)(2)). There is potential for indirect and cumulative effects on these other sites and properties. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be further removed in distance, or be cumulative (36 CFR §800.5(a)).

The APE for this Undertaking is comprised of 12,436 acres and is shown on the map attached hereto as Appendix B-2. The APE includes land and property interests owned or managed by the BLM and a private entity. In addition, several entities have easements and/or rights-of-way, including California Department of Transportation (Caltrans), SDG&E, San Diego & Arizona Eastern Railway, AT&T, and Imperial County. The Undertaking will occur in an environmental setting that includes the TCP as identified by the Tribes and its relationship and association to other sites, viewsheds including that towards Coyote, Signal and Sugarloaf Mountains and other properties which are outside the APE but may relate to the historic and cultural significance of the TCP that could be affected by implementation of the Undertaking (see additional map). If additional information reveals indirect and/or cumulative effects on other properties eligible for listing on the NRHP, revision of the APE may be appropriate.

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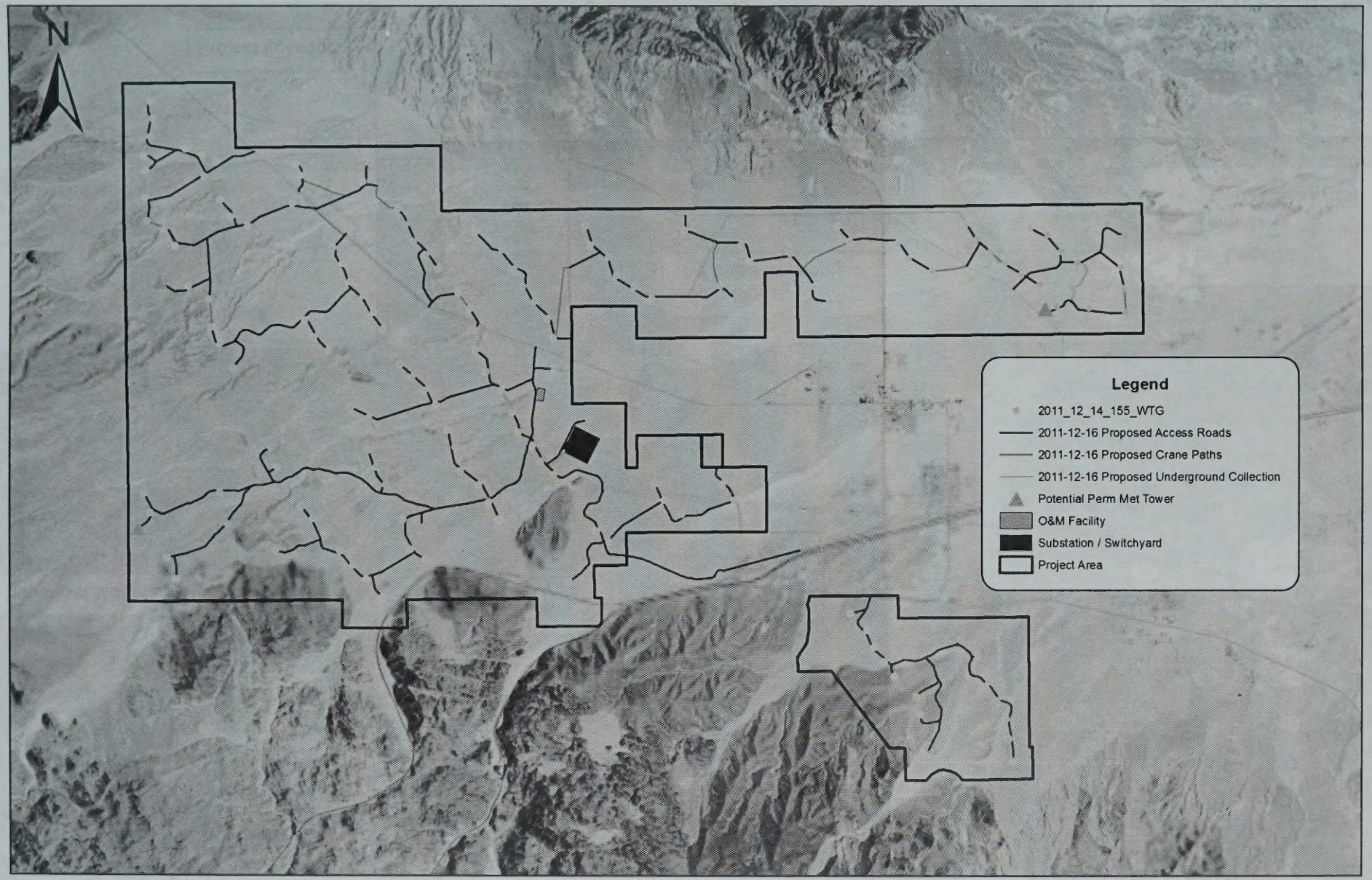
APPENDIX B-2: REFERENCE MAPS FOR THE AREA OF POTENTIAL EFFECT

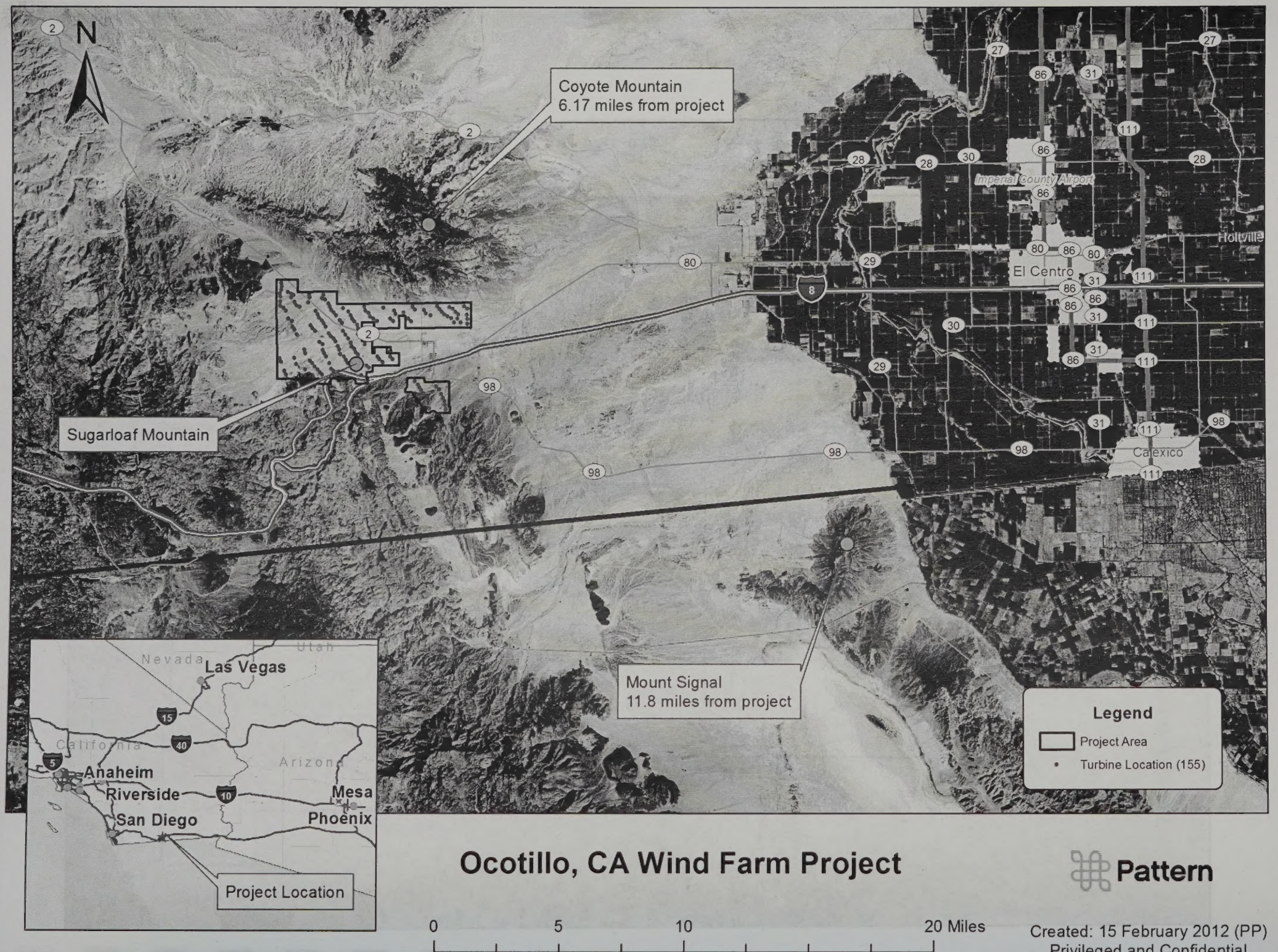


Ocotillo, CA Wind Farm Project
155 Turbine Site Plan

0 0.75 1.5 3 Miles

Pattern

Created: 27 February 2012 (PP)
Privileged and Confidential



Ocotillo, CA Wind Farm Project

Pattern

Created: 15 February 2012 (PP)
Privileged and Confidential

APPENDIX C: TABLE SUMMARY OF ELIGIBILITY AND MANAGEMENT RECOMMENDATIONS FOR ARCHAELOGICAL SITES

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
CA-IMP-008/H	Camp Site, Agave Processing Area, Rock Features & Historic Refuse Scatter	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-055	Artifact Scatter & Rock Feature	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-103/H	Artifact Scatter, Historic Mining Site & Refuse Scatter	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-443	Lithic Scatter & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-1427	Lithic Scatter & Rock Feature	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-1431/H	Artifact Scatter, Rock Features & Historic Mining Site	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-2430	Camp Site	Eligible (Criterion D)	Road	No	Avoid
CA-IMP-2471/H	Camp, Cremation, Trail & Historic Refuse Scatter	Eligible (Criterion D); contributor toTCP (Criterion A)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-2488	Lithic Scatter & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-3705/H	Artifact Scatter & Historic Refuse Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-3712	Lithic Scatter	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-3720H	Historic Mining Site	Not Eligible	Assembly Areas	No	Avoid
CA-IMP-6508/H	Artifact Scatter, Rock Features & Historic Refuse Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-6915	Camp Site	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-6919	Artifact Scatter	Eligible (Criterion D)	Assembly Areas	No	Avoid
CA-IMP-6920	Lithic Scatter &Trail/ Geoglyph	Eligible (Criteria C and D); contributor to TCP (Criterion A)	Collection Line	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-6921/H	Lithic Scatter, Rock Features, Historic Foundations & Refuse Scatter	Not Eligible	Assembly Areas	No	Avoid
CA-IMP-6922	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
CA-IMP-6923/H	Lithic Scatter, Historic Refuse & Road	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-6924	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-6988	Artifact Scatter, Agave Processing Area & Geoglyph	Listed (Criteria C and D); contributor to TCP (Criterion A)	Electrical Interconnect	Yes	Avoid; Temporary Fencing/Monitoring
CA-IMP-10885/H	Artifact Scatter & Mining Site	Not Eligible	Transmission/ Road	No	Avoid
OCO-003	Camp Site, Rock Feature & Modern Geoglyph	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-008	Lithic Scatter & Rock Feature	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-011	Lithic Scatter & Agave Processing Area	Not Eligible	Road	No	Avoid
OCO-012	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-014	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	No	Avoid
OCO-019	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	No	Avoid
OCO-021	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-023	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-024	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-025	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-026	Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	No	Avoid
OCO-AMC-001/H	Lithic Scatter, Rock Feature & Historic Refuse Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-003	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-004	Ceramic Scatter	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-AMC-005H	Historic Refuse Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-006	Ceramic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-010H	Historic Refuse Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-AMC-027H	Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-028	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-032	Lithic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-AMC-035	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-AMC-042	Lithic Scatter& Rock Features	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-044/H	Artifact Scatter, Agave Processing Area & Historic Mining Site	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-052	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-053H	Historic Survey Marker & Rock Feature	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-054	Camp Site & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-064	Lithic Scatter	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-065	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-AMC-066	Lithic Scatter & Rock Features	Not Eligible	Transmission/ Road	No	Avoid
OCO-AMC-067	Lithic Scatter & Rock Features	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-068/H	Lithic scatter, Rock Features & Historic Mining Site	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-069	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-AMC-070	Lithic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-072	Lithic Scatter & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-076/H	Lithic Scatter, Historic Mining Site & Road	Not Eligible	Turbine155	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-AMC-078	Lithic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-083	Modern Redeposited Artifact Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-086	Lithic Scatter	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-088	Lithic Scatter & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-090	Artifact Scatter	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-091	Artifact Scatter & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-094	Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-097	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-100	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-102	Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-125	Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-126	Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-AMC-129	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-AMC-130	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-AMC-500T	Trail & Rock Features	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-AMC-501T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-BF-001	Camp Site	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-004H	Historic Mining Site	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-005	Lithic Scatter & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-008	Lithic Scatter	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-009H	Historic Mining Site	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-012	Lithic Scatter	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-BF-013/H	Lithic Scatter, Rock Features & Survey Markers	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-017	Lithic Scatter & Rock Features	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-018/H	Lithic Scatter & Historic Mining Site	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-019/H	Lithic Scatter & Historic Mining Site	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-020	Lithic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-026/H	Lithic Scatter & Historic Mining Site	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-034	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-035	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-040	Artifact Scatter & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-041	Camp Site & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-042T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-044	Agave Processing Area	Eligible (Criterion D)	Road	No	Avoid
OCO-BF-048	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	No	Avoid
OCO-BF-049	Agave Processing Area	Eligible (Criterion D)	Assembly Areas	No	Avoid
OCO-BF-050	Agave Processing Area	Eligible (Criterion D)	Assembly Areas	No	Avoid
OCO-BF-054	Agave Processing Area	Eligible (Criterion D)	Assembly Areas	No	Avoid
OCO-BF-055	Agave Processing Area	Eligible (Criterion D)	Assembly Areas	No	Avoid
OCO-BF-056	Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-057	Ceramic Scatter & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-059	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-BF-060	Artifact Scatter	Not Eligible	Road	No	Avoid

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-BF-061	Agave Processing Area	Eligible (Criterion D)	Road	No	Avoid
OCO-CWB-001T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	No	Avoid
OCO-CWB-002T	Trail & Rock Feature	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	No	Avoid
OCO-CWB-003T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-CWB-004T	Trail & Rock Features	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	No	Avoid
OCO-EAM-001	Camp Site	Not Eligible	Transmission/ Road	No	Avoid
OCO-EAM-002	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-005	Lithic Scatter	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-010	Camp Site & Rock Features	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-011	Artifact Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-012	Camp Site, Trail & Rock Features	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-013	Lithic Scatter & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-014	Lithic Scatter & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-015	Lithic Scatter & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-017	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-018H	Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-019	Camp Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-020	Artifact Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-023	Lithic Scatter & Rock Feature	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-024	Lithic Scatter & Rock Feature	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-025	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-EAM-026	Lithic Scatter & Rock Feature	Not Eligible	Transmission/ Road	No	Avoid
OCO-EAM-027	Lithic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-028	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-030	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-EAM-031	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Road	No	Avoid
OCO-EAM-032	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-EAM-033H	Historic Mining Site	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-034	Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-035	Lithic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-036	Lithic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-037	Lithic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-038	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-EAM-039	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-EAM-040	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-042	Camp Site & Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-043	Lithic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-044	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-EAM-046	Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-047	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-048H	Historic Mining Site	Not Eligible	boundaries	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-049	Agave Processing Area	Not Eligible	boundaries	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-050	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-052	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-053	Lithic Scatter & Rock Feature	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-054	Artifact Scatter	Not Eligible	boundaries	Yes	Avoid; Temporary

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
					Fencing/Monitoring
OCO-EAM-055	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-056T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-057	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-058	Camp Site & Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-061	Artifact Scatter	Not Eligible	Road	No	Avoid
OCO-EAM-062	Lithic Scatter	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-064	Rock Feature	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-065	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-067/H	Lithic Scatter, Rock Features & Historic Mining Site	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-068	Agave Processing Site	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-069	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-070	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-071	Lithic Scatter & Rock Feature	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-072	Lithic Scatter & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-074	Camp Site & Rock Feature	Eligible (Criterion D)	Assembly Areas	No	Avoid
OCO-EAM-075/H	Artifact Scatter, Rock Features & Historic Refuse Scatter	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-076	Lithic Scatter & Rock Feature	Not Eligible	Transmission/ Road	No	Avoid
OCO-EAM-077	Camp Site & Rock Features	Eligible (Criterion D)	Transmission/ Road	No	Avoid
OCO-EAM-078	Lithic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-EAM-079	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-081	Lithic Scatter & Cremation Site	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	No	Avoid

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-EAM-082	Artifact Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-EAM-083	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-084	Artifact Scatter & Rock Features	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-085	Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-087	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-088	Artifact Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-089	Agave Processing Area	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-100	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-101	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-102	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-103	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-104	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-106	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-107	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	No	Avoid
OCO-EAM-108	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-109	Lithic Scatter & Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-110	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-111	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-112	Lithic Scatter & Agave Processing	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
	Area				
OCO-EAM-113	Lithic Scatter & Geoglyph	Eligible (Criteria C and D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-EAM-114	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-151	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-152	Camp Site & Rock Features	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-200T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-EAM-300H	Historic Mining Site & Refuse Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-JLU-173/H	Artifact Scatter & Historic Mining Site	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KAM-001T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Transmission/ Road	No	Avoid
OCO-KRM-001	Lithic Scatter & Rock Features	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-003	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-004	Lithic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-005	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-KRM-006	Artifact Scatter & Rock Features	Not Eligible	Turbine 155	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-007	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-008	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-009	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-020	Ceramic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-022	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-023	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-024	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-025	Artifact Scatter	Not Eligible	Road	No	Avoid
OCO-KRM-026	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-KRM-032	Artifact Scatter	Not Eligible	Road	No	Avoid
OCO-KRM-033	Ceramic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-037	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-044	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-KRM-048T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-051	Camp Site & Rock Features	Eligible (Criterion D)	Electrical Inter-connect	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-052/H	Lithic & Historic Refuse Scatter	Not Eligible	Electrical Inter-connect	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-053	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-059/H	Artifact Scatter, Rock Features & Survey Markers	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-KRM-065T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-KRM-066T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-KRM-067	Camp Site & Rock Features	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-001	Artifact Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-LPM-002	Lithic Scatter	Not Eligible	Transmission/ Road	No	Avoid
OCO-LPM-004	Lithic Scatter & Agave Processing Area	Not Eligible	Assembly Areas	No	Avoid
OCO-LPM-006	Artifact Scatter & Agave Processing Area	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-007	Lithic Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-008	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-009	Camp Site & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-010	Camp Site & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-011T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-LPM-012	Agave Processing Area	Eligible (Criterion D)	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-LPM-013	Agave Processing Area	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MD-001T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-MD-002T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-MD-003T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-MHN-001T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-MOW-001H	Historic Refuse Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-002	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-004H	Historic Refuse Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-005	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-010	Ceramic Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-MOW-011	Ceramic Scatter	Not Eligible	boundaries	No	Avoid
OCO-MOW-012/H	Artifact Scatter& Historic Mining Site & Refuse Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-MOW-013/H	Lithic Scatter, Rock Feature, Historic Refuse Scatter & Survey Marker	Not Eligible	Assembly Areas	No	Avoid
OCO-MOW-014	Artifact Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-MOW-016	Artifact Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-022/H	Artifact Scatter & Historic Mining Site	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-026H	Historic Mining Site	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-027H	Historic Mining Site	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-028	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-029H	Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
OCO-MOW-032	Lithic Scatter	Not Eligible	Electrical Interconnect	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-037H	Historic Mining Site & Survey Marker	Not Eligible	Road	No	Avoid
OCO-MOW-038	Artifact Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-039	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-040H	Historic Mining Site	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-042	Artifact Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-MOW-043/H	Ceramic & Historic Refuse Scatter	Not Eligible	Assembly Areas	No	Avoid
OCO-MOW-045H	Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-046H	Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-047H	Historic Mining Site & Survey Marker	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-048H	Historic Mining Site & Survey Marker	Not Eligible	Transmission/ Road	No	Avoid
OCO-MOW-049H	Historic Refuse Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-050H	Historic Refuse Scatter	Not Eligible	boundaries	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-051	Lithic Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-052/H	Ceramic Scatter & Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-054	Artifact Scatter	Not Eligible	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-055	Camp Site & Rock Features	Eligible (Criterion D)	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-059H	Historic Refuse Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-064/H	Artifact Scatter & Historic Mining Site & Refuse Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-065H	Historic Mining Site	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-066	Artifact Scatter	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-067H	Historic Mining Site & Survey Marker	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-068	Lithic Scatter & Rock Features	Not Eligible	Transmission/ Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-069	Lithic Scatter	Not Eligible	Assembly	Yes	Avoid; Temporary

Appendix C: Table Summary of Eligibility and Management Recommendations for Archaeological Sites					
Resource Designation	**Site Type**	**Recommended Eligibility**	**Nearest Project Component**	**Project Component within ESA's 150' Buffer**	**Construction Management Strategy**
			Areas		Fencing/Monitoring
OCO-MOW-070	Lithic Scatter	Not Eligible	Assembly Areas	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MOW-071	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-MOW-072	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-MOW-073H	Historic Mining Site	Not Eligible	Road	No	Avoid
OCO-MOW-074	Lithic Scatter	Not Eligible	Road	No	Avoid
OCO-MOW-200T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-MOW-201T	Trail	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-MTE-006/H	Camp Site & Historic Mining Site	Eligible (Criterion D)	Road	No	Avoid
OCO-SAC-003	Artifact Scatter & Agave Processing Area	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-SAC-100T	Trail & Rock Features	Eligible (Criterion D); contributor to TCP (Criterion A)	Assembly Areas	No	Avoid
OCO-VAP-023	Artifact Scatter & Cremation Site	Eligible (Criterion D); contributor to TCP (Criterion A)	Road	Yes	Avoid; Temporary Fencing/Monitoring
OCO-VAP-025	Artifact Scatter	Eligible (Criterion D)	Road	Yes	Avoid; Temporary Fencing/Monitoring
P-13-012210	Road (Dos Cabezas)	Not Eligible	Road	Yes	None

APPENDIX D: HISTORIC PROPERTIES TREATMENT PLAN

DRAFT HISTORIC PROPERTIES TREATMENT PLAN FOR THE OCOTILLO WIND ENERGY FACILITY PROJECT, IMPERIAL COUNTY, CALIFORNIA.

Prepared for:

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PN 18980.01

1. INTRODUCTION

Through consultation and resulting consensus, the Bureau of Land Management (BLM) has determined that the Ocotillo Wind Energy Facility (OWEF) Project will have an adverse effect on historic properties, including a National Register of Historic Places (NRHP) listed site, and a Traditional Cultural Property. Visual and auditory effects will change the character of historic properties in the project's area of potential effects (APE) and the qualities that make the resources eligible for the National Register of Historic Places (NRHP). As required by the OWEF Memorandum of Agreement (MOA) and the Draft Environmental Impact Statement (DEIS) Mitigation Measure CUL-4, a Historic Properties Treatment Plan (HPTP) has been developed in order to recover, document, and preserve the important archaeological and other significant values of the cultural resources affected by this project, thus resolving the project's adverse effects. As well, this HPTP details measures that have, and will be implemented to avoid adverse effects to other historic properties.

This document constitutes the HPTP for the cultural resources within the APE of the OWEF Project. This project involves the construction of no more than 112 wind turbines dispersed across a right-of-way (ROW) that is approximately 12,436 acres in size. This HPTP is designed to satisfy Stipulation III(b) of the MOA developed for this project, and Mitigation Measures outlined in the Draft Environmental Impact Statement (DEIS).

The next section of this document outlines the regulatory context for the project. Site avoidance procedures are discussed followed by a summary of the significant cultural resources and potential adverse effects that may result from the Project. Off-site/alternative mitigation measures and protection procedures during construction are then presented.

REGULATORY CONTEXT

This HPTP has been developed to assist the BLM in their compliance with Section 106 of the National Historic Preservation Act (NHPA), the California Environmental Quality Act (CEQA; PRC 21000 - 21177), and other applicable federal, state, and/or local laws, ordinances, rules, regulations, and policies.

Pursuant to 36 CFR § 800, the regulations implementing the NHPA, an MOA has been developed for OWEF Project. Stipulation III of the MOA and Mitigation Measure CUL-4 of the DEIS require the development of a Historic Property Treatment Plan (HPTP) for the project. This document is responsive to these stipulations.

NHPA Section 106 is applicable to federal undertakings, including projects financed or permitted by federal agencies, regardless of whether the activities occur on land that is managed by federal agencies, other governmental agencies, or private landowners. 36 CFR Part 800.1(a) states the purpose and goal of the Section 106 process as follows:

> The section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other

parties with an interest in the effects of the undertaking on historic properties commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties.

"Historic properties" are significant cultural resources that are listed in or determined eligible for listing in the NRHP. The criteria for NRHP eligibility are defined at 36 CFR §60.4 and include:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that:
>
> (a) are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) are associated with the lives of persons significant in our past; or
>
> (c) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) have yielded or may be likely to yield, information important in prehistory or history.

Significant impacts under CEQA, in slight contrast, occur when "historically significant" or "unique" cultural resources are adversely impacted. Historically significant cultural resources are defined by eligibility for or by listing in the CRHR. In practice, the NRHP criteria for significance applied under Section 106 are generally (although not entirely) consistent with CRHR criteria (see PRC §5024.1, Title 14 CCR, Section 4852 and §15064.5(a)(3)).

Under CEQA, significant impacts to cultural resources are those that alter or destroy prehistoric or historical archaeological sites, features and artifacts, and historical properties (e.g., buildings) that are themselves determined to be significant or unique. Significant archaeological resources and historical properties are defined as those that:

> (A) Are associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
>
> (B) Are associated with the lives of persons important in our past;
>
> (C) Embody the distinctive characteristics of a type, period, region, or method of construction, or represent the work of an important creative individual, or possess high artistic values; or
>
> (D) Have yielded, or may be likely to yield, information important in prehistory or history.

Unique resources under CEQA, again in slight contrast, are those that represent:

an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

(1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

(2) Has a special and particular quality such as being the oldest of its type or the best available example of its type.

(3) Is directly associated with a scientifically recognized important prehistoric or historic event or person (PRC § 21083.2 (g)).

MITIGATION REQUIREMENTS, DEIS AND MOA

As part of compliance with NEPA, the BLM prepared the DEIS for the OWEF to identify alternative and preferred turbine alignments, examine the relative effects of the alternatives on known historic properties, and identify mitigation measures that would reduce these adverse effects to a less than significant level. The cultural resource mitigation measures are outlined in the DEIS Mitigation Measures for the project. They include implementation of recommended BLM Best Management Practices (BMPs) from the BLM's Programmatic EIS for Wind Energy Development. Subsequently, the BLM executed the MOA as evidence that the Advisory Council for Historic Preservation (ACHP) was afforded the opportunity to comment on the undertaking. The mitigation measures provided in the DEIS shall be coordinated with the requirements of MOA and this document. A concordance is provided for each measure below.

2. AVOIDANCE AND PROTECTION MEASURES

The avoidance and protection of cultural resources within the OWEF APE is a primary goal of this plan, as outlined in Mitigation Measures C-1b and C-1e. Compliance with these measures included changes to the final project design involving re-alignments, adjustments and changes in tower locations.

As part of early project planning, all wind turbines were relocated to assure that there would be no effects within the physical boundaries of the archaeological and historical resources identified for the undertaking. Additionally, approximately 3000 acres were eliminated from the original ROW boundary to protect sensitive cultural and biological resources in the southwest corner of the project area.

Through continuing Section 106 and government-to-government consultation, the number of proposed turbines has been reduced from 155 to 112 to help reduce the visual effects to NRHP-listed site CA-IMP-6988 (Spoked-Wheel Geoglyph) in the direction of important geologic features including Coyote and Signal Mountains and to address impacts to the TCP and cultural

landscape identified by several Tribes. Turbines were also removed from the 155 layout to protect cremation locations.

3. CULTURAL RESOURCES WITHIN THE OWEF ROW

287 archaeological sites have been recorded within the Project APE (Tierra Environmental Services 2011) and the reader is referred to the Class III inventory report for information on these sites. Physical effects to all of these sites have been avoided by changes in turbine locations. CA-IMP-6988, known as the "Spoke Wheel Geoglyph", is located within the APE and has been determined as locally significant and eligible for the National Register of Historic Places (NRHP) under Criterion A for its association with historical patterns or events significant to the cultural traditions of the community. The Spoke Wheel Geoglyph was previously determined eligible and listed on the NRHP under Criteria C and D in 2003 because of its distinctive construction and the likelihood of providing important information.

The region containing the Ocotillo Wind Project was and continues to be acknowledged as a ritual landscape by Native American tribes. This Colorado Desert more widely was the setting for mythic events that resulted in the creation of the world, the tribes themselves, and their individual ritual practices (Bourke 1889; Kroeber 1925; von Werlhof 2004; Whitley 2000). Specific locations may be associated with individual mythic spirits and events, including the creator; and known routes follow their mythic movements across the region. In ethnographic and contemporary times, rituals were/are conducted at the locations of these mythic events, and pilgrimages and initiations were/are undertaken to follow the sequence of mythic events, following designated trails. These rituals include spiritual cleansing, honoring the creator and other spirits, healing, acquiring supernatural power or assistance, burial, and puberty initiations, among others. Based on chronometric analyses of specific ritual sites, the time-depth of these practices is believed to be at least 2000 years (Dorn et al. 199X).

Ritual/mythic locations are also important in the transmission of cultural knowledge between generations, and are used for educational purposes. They are further important in fostering indigenous self-identity, and preserving social memory (Whitley and Whitley 2012). The ritual landscape, in this sense, can be understood as having both religious and social importance to the tribes. Because many mythic beliefs and ritual practices are shared among the tribes in the region, despite potentially different languages or dialects, concern with and use and knowledge of this ritual landscape is widespread.

The use of these ritual locations and landscape features varies and, depending upon circumstance, can involve group or alternatively private ceremonies. Some rituals are conducted regularly; others less frequently but still periodically; and still others, only rarely. Some locations are associated with very specific spirits and/or powers, and may only be used by or under the direction of individuals with appropriate knowledge and training; other ritual locations may be employed by any individual, with the appropriate intent and attitude. The nature of the ceremonies conducted also varies, depending upon location, purpose, and numbers of individuals

involved. The rituals range from group events involving singing and dancing, the public recitation of mythic sequences, lengthy group runs across the landscape to foster dreams signaling the acquisition of supernatural power, puberty initiations of various kinds, individual and private prayer, fasting and meditation, censing with white sage, cremation of human remains, deposition of offerings, the construction of earth figures and cairns, to the creation of petroglyphs.

Archaeological manifestations of these rituals include trails, cairns, dance circles and paths, offerings, petroglyphs and, especially earth figures. Otherwise ostensibly natural features, including springs, rockshelters/caves and locally prominent peaks are also common components of the ritual landscape, and potentially may be invested with more religious significance than humanly-constructed ritual places (Whitley 1998). Coyote Mountain, north of the Project, has been identified as one such sacred feature as has Signal and Sugarloaf Mountains. Regardless of specific form, ethnography across far western North America emphasizes the importance of the view-shed of many ritual locales (e.g., Hudson et al. 1979; Keyser and Whitley 2000; Stoffle et al. 2001). View-shed may have been important for celestial observations, and may have involved the positioning of alignments and/or rock art (e.g., with solstitial events). Alternatively, certain rituals may have been primarily conducted facing a specific direction, often towards a mountain that itself has religious significance.

Through consultation with Indian tribes on the OWEF project, a TCP and cultural landscape that has cultural and religious value pursuant to the above discussion has been submitted to the BLM as a sacred site under Executive Order 13007. It encompasses the OWEF APE. For the purposes of project management the BLM assumes the portion of the TCP (and associated cultural resources) as identified by the tribes within the Project area is eligible for the NRHP.

4. ADVERSE EFFECTS

Ethnography throughout far western North America documents the widespread Native American belief that development, including the construction of railroads, transmission lines and dams, within or in the vicinity of sacred sites destroys their spiritual values (see citations in Whitley 2000). The construction of a wind farm within the TCP has the potential to result in adverse effects to the values that make this area important to Native Americans, including their ability to continue traditional uses. While the proposed project has been designed to avoid physical impacts to the archaeological resources, the construction and operation of wind turbines within the TCP will result in visual and auditory effects that have the potential to impact the use of these locations for religious purposes. Inasmuch as the ritual landscape extends beyond the project ROW, and visual and auditory effects cannot be limited to the project boundaries, adverse effects may also occur to additional ritual sites in and traditional uses of the landscape as a whole.

5. OFF-SITE TREATMENT MEASURES

A number of off-site/alternative treatment measures will be completed to resolve adverse effects resulting from the project. Off-site treatment measures were determined through both BLM consultations with the project's consulting parties including Indian tribes. The cost of the treatment measures will be borne by the applicant.

In accordance with CUL-1, -2, -3 and -4, within 60 days of the issuance of the notice to proceed for this Project, Ocotillo Express LLC will identify to the BLM the consultant(s) who, under contract to Ocotillo Express LLC, will be responsible for developing and completing the off-site treatment products described below as appropriate with the exception of the Tribal Access Plan. Prior to carrying out any activities related to any treatment measure, the consultant(s) shall meet with the BLM and Ocotillo Express LLC to discuss the goals of the project and work plan requirements, including lines of communication, deliverables, schedules, and any terms and conditions.

Within 45 days of meeting with the BLM and Ocotillo Express LLC, and prior to initiation of any work related to the specific measure, the consultant(s) will provide the BLM with a draft Work Plan for completing the work required. The work plan shall document lines of communication, key personnel, and provide any appropriate contexts to support the design and methods proposed for completion of the mitigation measure. The work plan shall also include a schedule of milestones and timeline for completion of the work.

The BLM will provide copies of the draft work plan to the consulting parties in accordance with the communication and reporting procedures in Section VII of the MOA upon request. Upon approval of the work plan by the BLM, the BLM will authorize Ocotillo Express LLC and the consultant(s) to initiate work. Any products or studies described in the mitigation measures required by this Agreement will be developed in a manner to allow other proposed undertakings that may occur in the region to augment or expand the scope of the products or studies, provided that such augmentation or expansion proposed by other undertakings are the result of consultation under Section 106 or is an appropriate mitigation measure developed through the NEPA or CEQA process, cost sharing is provided as appropriate and developed in consultation with Ocotillo Express LLC and the BLM, and that no additional burden be placed on Ocotillo Express LLC unless the proposed measures is related to an Ocotillo Express LLC undertaking.

Tribal Access Plan

In accordance with CUL-9 and 11, although it may not be possible to entirely eliminate potential visual and auditory impacts to the ritual landscape, the applicant will develop a Tribal Access Plan to address ritual sites access and management issues with the lead agency and Indian tribes. This Plan will ensure reasonable access to these sites for ceremonial and other traditional uses, through the establishment of a calendar scheduling periodic dates for access, and/or using a specified advance notification system to arrange access. The Plan may include provisions for the reduction of impacts from turbines within a half-mile of the sites, to the degree possible, during tribal visits and protection of privacy. It may include a program of monitoring and, if necessary,

treatment to ensure the physical stability and integrity of the ritual sites within the Project ROW to be coordinated through Appendix E: Long Term Management Plan of the MOA.

Ultimately, the measures included in the Tribal Access Plan must be informed by Native American input on how best to address potential impacts to ceremonial practice and cultural sensitivities associated with traditional uses of the Spoke-Wheel geoglyph and other elements of the TCP. This can be done without disclosure of proprietary information about cultural practice. In general, various strategies can be devised to maintain privacy and confidentiality of ceremonial practice and mitigate project visual and auditory impacts during Native American access. Several general strategies are proposed here for which specific implementation can be developed through NA consultation and project design improvements. They include:

- Construction of post-and-cable barriers along access roads in proximity to the geoglyph to prevent cars stopping during ceremonies and to decrease the potential for direct or indirect impacts.
- Strategically placed natural landscaping such as boulders or berms to increase privacy
- Scheduling of Native American access when construction activities and subsequent maintenance activities are not occurring.
- Maintaining exclusion zones around the geoglyph during schedule ceremonial uses.

Ethnographic Study

In further accordance with CUL-9, an ethnographic study to further document the tribal values of the historic properties within the project area that are considered of religious or cultural significance by Indian tribes and tribal organizations shall be developed. The study will explore how these resources fit into the larger TCP and cultural landscape as identified by Tribes and document and identify the boundaries of the larger TCP and its potential eligibility to the NRHP. If the recommendation is that the TCP is eligible to the NRHP, a formal nomination to the NRHP shall be prepared.

As part of this ethnographic study, the applicant may include a program designed to train and support interested Native American tribal members in ethnographic data collection and analysis, provide direction and guidance in the collection of their tribal ethnographic data, and assist with the writing of the specific tribal ethnography, by members of those tribes. The focus of this study shall be the ritual landscape within and surrounding the Project ROW, including traditional uses of this landscape and its sites. To the degree possible, data collected in this study will be made available to the BLM for future planning purposes. At the request of individual tribes, however, specific tribal data may be kept confidential and not shared with the public, agencies, archaeologists or anthropologists, or other tribes or groups.

Regional Synthesis and Study

In accordance with CUL-4, the BLM acknowledges that further research may reveal the potential for a district or multiple districts to exist within the project area. Further research may also reveal that some of the archaeological resources within the project area may be part of a larger previously identified district, such as the In-Ko-Pah Gorge Discontiguous District; the Yuha

Basin Discontiguous District, or a larger yet-to-be identified district, whose boundaries may extend outside of the project area. There is also a potential for the additions to the multiple property listing of the Earth Figures of the California-Arizona Colorado River Basin Thematic Group.

A synthesis study will be prepared of existing data to explore the potential for one or more archaeological districts using a regional approach and the latest GIS technology; and if district(s) are identified, or have elements that are contributing to existing districts, formal NRHP nomination forms shall be prepared.

Prehistoric Trails Continuation Study

The project APE is located at the very center of a currently proposed Yuha-Jacumba Prehistoric Corridor Cultural Landscape (Noah 2012). Anchoring this context study is a partially reconstructed network of trails and travel corridors that native peoples used for movements between the desert lowlands and mountainous uplands. These trails served multiple purposes including seasonal transhumance, trade, cultural exchange, ceremonialism, and access to localized resources such as toolstone, soapstone, agave, mesquite, Lake Cahuilla wetland resources, acorns, and pine nuts, to name a few.

The project area is located in a particulary important zone for addressing many of the research questions that are posed in the Yuha-Jacumba context study. This western end of the Palm Canyon Wash Basin is at a virtual gateway between the desert and upland zones that were connected by several intersecting travel corridors. One major route that was used by the Kamia bands of Ipai/Kumeyaay and described by Gifford (1931) ran up In-ko-pah Gorge to Jacumba Valley and points east. Two routes described by Tom Lucas of the Kwaaymai band (Cline 1979) ran up Carrizon Canyon and Carrizo Gorge, respectively, and intersected on the desert floor west of Ocotillo. Other routes, such as one extending south through Davies Valley are also documented. Some segments of these routes are known from ethnographic or historical accounts while others are hypothesized from what appear to be natural landscape corridors (von Werlhof 1979). Archaeological evidence of these specific trails systems provide only an incomplete corroboration because of natural forces and historical roads or developments that have obliterated physical traces. Many additional trail segments remain to be discovered through archaeological survey. Where trails segments no longer exist, the spatial analysis of localized artifact types such as ceramics and geologically specific tool stone are indirect evidence for travel routes. A major research objective of the cultural context and with direct application to research in the project area is the articulation of additional empirical evidence of this trail network both within the APE and as it can traced beyond its limits.

Educational and Interpretive Program

The applicant shall fund a program to enhance and support public education and interpretation at the Imperial Valley Desert Museum in Ocotillo, California. This program must include provisions for the interpretation of Native American past and present uses of the area to communicate the importance of the values embodied in the archaeological and cultural resources

contained within the project and facilitate a better understanding of these values to the lay public and other stakeholders.

Professional Curation Management Training

A representative from each tribe shall be provided with training in curation and cultural resources artifact preservation. The training opportunity shall utilize existing museum or other facilities that offer on-site training programs or it will provide the training at a locally organized facility through the use of professional contractors.

Monitoring Training for Tribal Monitors

If interest is expressed by tribes involved in the Tribal Participation Plan, as outlined under Stipulation IV(b) of the MOA, a program of training for Native American monitoring will be developed and implemented. This will include instruction in compliance with NHPA Section 106, daily reporting procedures and other practical details, as suggested by the participants.

Video Documentation of Traditional Songs

A broadcast quality video (not to exceed 30 minutes) shall be produced in partnership with tribes and their members to document the traditional songs and dances that may be associated with the Project area. The product may also feature images of the project landscape before construction, interviews with knowledgeable Native Americans about this specific traditional landscape and its importance to tribal values, and a discussion of the different components of a traditional landscape within the project area.

Support for Linguistic Programs

The applicant shall provide financial support to existing or new native language programs or initiatives being conducted by tribes in the region. This will assist in the perpetuation of these languages, as well as associated traditional beliefs and practices.

6. SITE PROTECTION DURING PROJECT CONSTRUCTION

In accordance with CUL-5, -6, 7, 8 and 10, the BLM and the Applicant, in consultation with Tribes and the appropriate land owner(s) and within the limits of agency authority, will identify and implement resource protection measures during the period of construction, such as fencing, gating, and law enforcement patrols, to stabilize and/or protect cultural resources within the vicinity of the APE during the construction. Where continuing resource protection measures are considered appropriate after the period of construction, such measures will be developed as provided in Stipulation IV(c) of the MOA and appropriate Appendix documents.

A series of measures will be completed to ensure that known and previously undiscovered sites are not adversely affected during Project construction.

Subsurface Testing at Turbine Locations

All proposed turbine locations have been positioned to avoid direct disturbance to known archaeological sites. Prior to construction, subsurface archaeological testing may be conducted at certain turbine locations to ensure that subsurface archaeological deposits are not present that would be inadvertently destroyed by the project. This testing will involve the excavation of eight (8) Shovel Test Pits (STPs) at each turbine location, including the screening of the removed spoils in order to identify potential artifacts or archaeological specimens. Should a subsurface archaeological deposit be identified, that resource will be evaluated and the turbine location would be repositioned or eliminated as appropriate (see procedures outlined in Appendix F: Plan for Archaeological Monitoring, Post-Review Discovery, and Unanticipated Effects). A Native American monitor will be present during all archaeological testing procedures.

ESAs

In order to ensure that sites are not impacted during the construction of the Project, all recorded site areas within 150 feet of areas of direct impact, including turbine locations, access roads, operations facilities and staging zones, will be temporarily fenced as Environmentally Sensitive Areas (ESAs). No access of any kind will be permitted into these areas by Project personnel or equipment without prior authorization.

Monitoring During Construction

A team consisting of a Native American and an archaeologist shall be present to monitor all construction activities that will be present during all construction activities with 150 feet of known sites. These monitors will have stop-work authority in the event that cultural resources are threatened.

Law Enforcement Protection

In accordance with CUL-12, the applicant shall fund a program, in consultation with the BLM and tribes that will enhance law enforcement and ranger patrols and protection of the cultural resources within the ROW during the life of the Project, including during construction and operation of the wind farm.

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APPENDIX E: LONG TERM MANAGEMENT PLAN

APPENDIX F: PLAN FOR ARCHAEOLOGICAL MONITORING, POST-REVIEW DISCOVERY AND UNANTICIPATED EFFECTS

DRAFT

MANAGEMENT PLAN FOR ARCHAEOLOGICAL MONITORING, POST-REVIEW DISCOVERY, AND UNANTICIPATED EFFECTS

For The

OCOTILLO WIND ENERGY PROJECT

IMPERIAL COUNTY, CA

Submitted to:

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1. INTRODUCTION

This Management Plan (Plan) was prepared for the Ocotillo Wind Energy Facility Project (Project) in western Imperial County, California. Pattern Energy, Inc., through Ocotillo Express LLC, is proposing to construct, operate and maintain a wind energy generation facility consisting of up to 155 wind turbine generators with a total capacity of 356.5 MW. Tierra Environmental Services, Inc. (Tierra) of San Diego was commissioned to conduct an archaeological survey of the Project area. This Management Plan describes methods to be implemented for the protection and avoidance of effects to all archaeological sites in the APE identified. This Management Plan also describes methods for the treatment of inadvertent or unanticipated discoveries.

1.1 APPLICABILITY

The following Management Plan applies to all properties that are considered in the Project as approved by the BLM and defined below. The BLM has overall jurisdiction for ensuring the actions stipulated in this plan are implemented to comply with Section 106 of the NHPA, unless otherwise stipulated in the *Memorandum of Agreement Among the Bureau of Land Management-California, the United States Army Corps Of Engineers, Ocotillo Express LLC, the California State Historic Preservation Officer, and the Advisory Council On Historic Preservation Regarding the Ocotillo Express Wind Energy Project Imperial County, California* (MOA) or in the following plan. The County of Imperial will be consulted on all matters concerning private lands and the regulations set forth in CEQA. The Management Plan is in accordance with the MOA Stipulations IV through VII that govern Monitoring, Post Review Discoveries and Unanticipated Effects, Treatment of Human Remains of Native American Origin and Communication and Reporting.

2. CONSRUCTION MONITORING

2.1 ENVIRONMENTALLY SENSITIVE AREAS (ESAs)

Sites that can be protected from direct physical impacts, but are within close proximity (within 150 ft) of proposed construction activities will be identified and labeled as Environmentally Sensitive Areas (ESAs). This includes archaeological sites determined eligible for inclusion in the National Register of Historic Places (NRHP) or California Register of Historic Resources (CRHR) and sites that have not been formally evaluated, but are being treated as eligible and avoided for project management purposes [see Stipulation III(a)(i) of the project MOA].
As noted in Stipulation III(a) of the MOA:

a) Where archaeological resources are avoided, the BLM will implement the management or protective measures identified in Table 1 of Appendix C of the MOA and the following:

   i. Archaeological sites that are protected from physical impacts, but are within 150 feet of proposed construction activities, will be identified and labeled by archaeological and Native American monitors as Environmentally Sensitive Areas (ESAs). This includes archaeological sites determined eligible for inclusion in the NRHP and sites that have not been formally evaluated, but are being treated as eligible and avoided for project management purposes.

   ii. The ESAs will be designated by marking the boundaries of sites with appropriate buffer zones using temporary fencing or other easily recognizable boundary defining materials.

      (1) These ESAs will be shown on the engineering plans for the Project as off-limits to construction activities.

      (2) Once established, an ESA will define areas where construction activities cannot occur to prevent damage to historic properties within the designated ESA.

      (3) Construction work areas will also be clearly defined using temporary fencing or other easily recognizable boundary defining materials.

The establishment of ESAs is a non-destructive means to avoid impacts to recorded cultural resources within the project. The ESAs will be designated by marking boundaries of known sites or other identified areas with appropriate buffer zones using temporary fencing, stakes, and /or flagging. ESAs will not be marked or identified as archaeological sites to avoid disclosure of sensitive resources. Once established, ESAs will define areas where construction and restoration can occur while preventing activities and damage to archaeological resources within them.

ESAs will be identified and established by a qualified archaeologist using sub-meter GPS unit(s) prior to initiation of ground disturbing activities and will be maintained and monitored for the duration of the work effort in the ESA vicinity, with archaeological monitoring of construction and restoration activities required within 150 ft of all ESA locations. The archaeological monitors will report on any violations of the protected areas. ESAs will not be identified and labeled when significant cultural resources are located more than 150 ft from proposed construction activities, and such areas of proposed construction activities will not be monitored.

2.2 CONSTRUCTION MONITORING

Archaeological monitors will be present during construction activity at selected locations based on the occurrence of recorded archaeological sites and ESAs.

While the Draft MOA stipulates [Stipulation IV(a)(i)] that a comprehensive monitoring plan may be developed in consultation with the parties to the MOA, in absence of such a comprehensive plan, the following stipulations shall apply:

(1) The Applicant (Ocotillo Express LLC) shall ensure that archaeological monitors will be on site during construction to observe grading, trenching or other ground disturbing activities for any facilities, roads or other project components related to the undertaking near ESAs and in other areas designated for full-time monitoring, as detailed in Stipulation III, Appendix C and/or Appendix F.

(2) Ocotillo Express LLC shall ensure that archaeological monitors will meet the standards specified in Stipulation VIII(a), will be approved and permitted by the BLM, will be familiar with the types of historic and prehistoric archaeological resources that may occur in the APE, and will be directly supervised by a principal investigator (PI).

(3) Ocotillo Express LLC shall ensure that the PI will submit bi-weekly documentation of archaeological monitoring activities to the BLM by email. Documentation will include the location of archaeological monitoring activities for the reporting time period, as well as a description of any archaeological resources identified and any actions taken. The PI will prepare a monthly field monitoring verification report with the compiled monitoring observations, results, and actions taken for submission and approval to the BLM. The BLM will provide copies of biweekly and monthly archaeological monitoring reports to the consulting parties, unless otherwise directed by a consulting party.

(4) Upon completion of all archaeological monitoring tasks and requirements implemented pursuant to this Agreement, Ocotillo Express LLC shall ensure that the PI will submit within three months a final monitoring report to the BLM for review and approval. The final monitoring report will describe the monitoring program and its findings and results, and present a detailed professional description, analysis, and evaluation of any cultural resources that were encountered and evaluated during construction. The BLM will provide a copy of the monitoring report to the consulting parties.

Schedule and Notification

A tentative schedule for construction activities will be provided by the construction company in consensus with Ocotillo Express LLC. Ocotillo Express, by way of the PI will disperse this construction schedule as and when it becomes available to all cultural monitors. It is the objective of Ocotillo Express and Tierra to supply the all cultural monitors with adequate advance notice of one week prior to the commencement of initial construction. The construction site manager will notify the PI at least five days prior to mobilization of work in all areas identified as requiring cultural resource monitoring. Updates to the construction schedule will be distributed as appropriate and as available.

Training

Training of all project construction personnel will be conducted prior to the commencement of construction activities. The training program will be designed by Tierra and Ocotillo Express LLC in consultation with the BLM, and must be completed by all project personnel prior to entry into the project area.

All project personnel will attend a safety and Worker Environmental Awareness Program (WEAP) prior to the start of the construction activities. All cultural monitors will be required to complete safety and WEAP training prior to commencing work on the project. The WEAP training program must be completed by all personnel prior to entry into the project area. Additionally, all cultural monitors will be trained on or prior to their first day in the field by the PI on jobsite protocol, their duties and expectations regarding field activities, lines of authority, reporting, and documentation.

2.2.1 MONITORING BY ARCHAEOLOGISTS

The archaeological monitors will be qualified archaeologists who are familiar with the types of historical and prehistoric resources that could be present in the Project and will be directly supervised by a Principal Investigator (PI). The PI will be approved by the BLM prior to construction. A monitor can prevent damage to a site by being able to communicate well with others involved in the project. The PI is responsible for taking action/reporting on all unanticipated effects to cultural resources as well as for making final determinations of archaeological origin. It is the responsibility of the PI to take action and make final determinations for the unanticipated effect of the cultural resources.

Full time monitoring by a professional archaeologist and will occur during all construction activities near ESAs and in other areas determined appropriate for full time monitoring. Should an inadvertent discovery during the monitoring effort be identified, the archaeologist on site will immediately notify the PI of the discovery. Due to the Project's large scale and compacted schedule, it is probable that multiple construction crews will be working near ESAs simultaneously. In this event, should the PI not be immediately available to respond to a concern expressed, the archaeologist on site will have the authority of the PI to halt work for allowance of the inadvertent discovery to be properly assessed and appropriately treated. At a minimum, the duties performed by the archaeological monitors include:

(1) Requesting excavation work to be re-directed so that new discoveries can be evaluated;

(2) Sharing information so that others will understand the cultural importance of the features involved;

(3) Ensuring excavation that is disturbing a site is halted and the appropriate laws are followed when human remains are discovered;

(4) Helping to insure that Native American human remains and any associated grave items are treated with culturally appropriate dignity, consistent with the Native American Graves Protection and Repatriation Act (NAGPRA) or applicable state law;

(5) Coordination with tribal consultants consistent with the Tribal Participation Plan (TPP) [see Section 2.2.2 below].

Archaeological monitors will be required to submit daily logs denoting activities, resources, and any actions observed. As noted in the MOA monitoring stipulations noted in Section 2.3 Construction Monitoring, the PI will be responsible for the submission of biweekly, monthly, and final monitoring reports to the BLM for the duration of project construction. Copies of these reports will be provided to the consulting parties of the MOA by the BLM. In the event that ESAs require modification, all project work in the immediate vicinity will be diverted to a buffer distance determined by the archaeological monitor until authorization to resume work has been granted by the BLM or CEQA lead agency (see Chapter 3). Ocotillo Express LLC will notify the BLM or CEQA lead agency [County of Imperial] of any unanticipated effects to cultural resources or ESAs immediately. If such affects occur, Ocotillo Express LLC will consult with the BLM or the CEQA lead agency to mitigate damages and to increase effectiveness of ESAs. Such mitigation may include, but not be limited to modification of protective measures, refinement of monitoring protocols, data-recovery investigations, or payment of compensatory damages in the form of non-destructive cultural resource studies or protection within or outside the license area, at the discretion of the BLM, following consultation with interested parties, or the CEQA lead agency.

In addition to standard surveying equipment (GPS units, cameras, measuring tape, etc.) all archaeological monitors are required to have the basic equipment needed to complete minimal documentation, preliminary evaluation, and recovery of unanticipated discoveries, including a screen, shovel, and a bucket. If the evaluation or data recovery work prescribed is more extensive than the archaeological monitor alone can complete in an expeditions manner, the archaeological consultant will supply additional crew and equipment for the work. All recovered archaeological materials will be taken back to the consultant's laboratory for processing, analysis, reporting, and preparation for curation.

Monitoring Reporting for ESAs

Daily Logs

Daily logs depicting observances and activities will be completed by all cultural monitors, archaeologists and cultural consultants alike. The logs will be submitted at the end of each day to the PI.

Summary Reports

Preliminary archaeological monitoring summaries will be submitted biweekly by the archaeological monitoring consultant to the BLM for review with the intended goal of distribution to all consulting parties by email along with monthly verification report described below. Preliminary results will include the location and activities conducted during the archaeological monitoring activities for the reporting time period, as well as a description of any cultural resources identified and appropriate action taken. The archaeological consultant will prepare a monthly field monitoring verification report with the compiled archaeological monitor observations, results, and actions taken for submission to the BLM. The report will be submitted to Ocotillo Express LLC, the agencies and other stakeholders after review by the BLM. Copies will also be provided to the consulting parties of the MOA.

Monitoring Report

Upon completion of all monitoring tasks and requirements the archaeological consultant will prepare a monitoring report for the BLM or CEQA lead agency and other stakeholders describing the monitoring program, the findings and results of the monitoring effort, and presenting a detailed professional description, analysis, and evaluation of any cultural resources that were encountered

and evaluated during construction. The monitoring program consists of the methods utilized to determine designated monitoring locations, the observations noted during the monitoring effort (ie: construction machinery and activities, cultural resources observed, biological and/or geographical observations as they pertain to cultural resources, etc), as well as protocols for cultural resources encountered during the effort. A draft version of this report shall be submitted to the BLM for initial review within three months of completion of all archaeological monitoring tasks and requirements. Once it has been reviewed by the BLM, the draft report shall be provided to all consulting parties for a 30 day review period. The final report will be provided to all consulting parties along with a written documentation of any changes. Non confidential data will also be disseminated to the public and other interested parties, as appropriate.

2.2.2 Tribal Participation Plan (TPP)

As stipulated in the MOA [Stipulation IV(b)], a Tribal Participation Plan (TPP) will be developed to facilitate continued tribal consultation for this undertaking by Ocotillo Express LLC and interested Tribes, in consultation with the BLM. This plan will provide representatives designated by Tribes (tribal cultural consultants) the opportunity to monitor and be on site during construction to observe grading, trenching or ground disturbing activities for facilities, roads or other activities near ESAs and in other areas designated for monitoring as detailed in Appendix C and/or F of the MOA.

The TPP will describe the role of all parties in the program, specify the terms, expectations, notifications, reports, training and/or deliverables to be provided, and include a specific procedure to be followed in the event that a tribal cultural consultant is not provided or is not available. The tribal consultants will be designated by the Tribes and contracted by the PI. The TPP will be finalized and implemented prior to the start of ground-disturbing activities in areas designated for monitoring (see Stipulation IV(b) of the MOA).

3. TREATMENT FOR UNANTICIPATED DISCOVERIES

3.1 DISCOVERY AND EVALUATION

In the event of an unanticipated discovery of archaeological materials within a work area during construction monitoring, all ground disturbing work at that area will be suspended or redirected. The archaeological monitor will carefully inspect the ground surface around the discovery and the displaced dirt in order to determine whether the discovery is an isolated find (fewer than three items) or a site (three or more items, or a feature). If the find is determined to be an isolated find (with the exception of human remains or items of cultural patrimony), the discovery will be documented on the appropriate Department of Parks and Recreation 523a form, reported and described in the monitoring report; all consulting parties will be apprised of such discoveries in the biweekly monitoring summaries. Isolated finds will only be collected if they are diagnostic artifacts. Please see Action Plan Chart 1 in the Appendix for further information.

If the discovery is determined to be a site, after securing the work area from additional disturbance, in concert with the construction site manager, the PI will notify the BLM or CEQA lead agency archaeologist immediately by telephone of the nature and extent of the discovery. In consultation with the PI, the BLM or CEQA lead agency [County of Imperial] will determine what additional fieldwork is necessary, such as limited test excavation, to determine the site's potential eligibility for the NRHP or CRHR. It may be determined that a site visit by the BLM or CEQA lead agency is necessary to make that determination. Avoidance and protection of the site will be the first strategy investigated. In the event that avoidance is not possible, evaluation will be necessary and the newly discovered site will be designated as an Unavoidable New Discovery (UND).

If test excavation is required to evaluate an UND, the PI in coordination with the BLM (or County if on private land) will formulate a testing program at that time, taking into account the site type, research issues, methods, and interpretive criteria against which the site will be evaluated, and it will be implemented. In general any evaluation effort will be focused on the area of discovery within the area of impact including a reasonable buffer (not more than 10 m from the maximum extent of the find). The focus will be to determine the nature of the archaeological resource and to assess the quantity, quality, and variety of archaeological items that are or may be present. Evaluation will include Controlled Surface Collections (CSC), Shovel Test Pits (STPs) of a sufficient number to characterize the extent of subsurface archaeological deposits and a minimum of one Control Unit (CU) to evaluate the condition of the discovery and acquire a controlled sample of the preserved cultural materials. For additional information, please see Section 3.2.

After site evaluation the PI will have five business days in which to prepare a summary letter report assessing the site's eligibility and recommending appropriate treatment measures, such as the need for archaeological data recovery, if the site is recommended eligible. The letter report will be submitted to the BLM or CEQA lead agency, and the consulting parties as appropriate, who will have 10 business days to review the report and evaluate the proposed treatment measure. Determinations concerning NRHP or CRHR eligibility and the implementation of proposed treatment measures will be made by the BLM or the CEQA lead agency. If any portions of the site within the Area of Direct Impact (ADI) on private property and BLM administered lands meet the following conditions, they may be determined not contributory to the NRHP/CRHR eligibility of the entire site, in addition to the ADI, as a whole, by the BLM in consultation with the CEQA lead agency, where necessary, if:

1. the ADI lacks intact subsurface archaeological deposits;
2. the ADI lacks chronological data;
3. no human remains are present within the ADI or known on the site as a whole;
4. no intact features are present within the ADI other than bedrock milling stations, lithic chipping stations or historical refuse scatters determined to be single incident refuse dumps;
5. in addition, prehistoric/Native American surface artifact densities within the ADI shall not exceed 0.5 archaeological specimens per meter square or contain more than three types indicating a diverse assemblage.

No further SHPO consultation will be required for eligibility determinations for site areas that meet the above conditions. Findings that exceed these criteria will be submitted to the SHPO for concurrence for a 10-day review period. If the determination is that the discovered resource is not eligible for listing in the NRHP or CRHR, the BLM or CEQA lead agency will issue written notice to proceed for all BLM-administered lands, or in consultation with the CEQA lead agency for state or private lands.

If a discovered site is determined to be eligible for the NRHP or CRHR, further treatment measures will be required. In consultation with the BLM, CEQA lead agency, and other consulting parties, the PI will prepare a data recovery plan for BLM review and approval for all BLM land, and for review and consultation with the CEQA lead agency for state or private lands. After review and concurrence, the BLM or CEQA lead agency archaeologist will notify the PI that the proposed data recovery plan can proceed. Data recovery efforts will be focused only on that portion of the site within the area of impact with a reasonable buffer. To the degree possible the construction and engineering teams will be included in discussions to avoid or minimize potential damage to the discovered resource. Any portion of a site undergoing data recovery will be fenced until implementation of the data recovery plan is completed.

The level of effort will be dictated by the nature and extent of the discovery and on the results of the initial evaluation effort. The focus will be on recovering a sufficiently large sample to characterize the discovery and to address regional research questions, as appropriate. Upon completion of any required fieldwork the PI will prepare a brief interim letter report summarizing the results. The BLM or CEQA lead agency archeologist will have five business days to review the report and determine whether or not construction work at the discovery site can resume or if additional sampling is required. The BLM or CEQA lead agency archaeologist in consultation with the other stakeholders will notify Ocotillo Express LLC when work can resume. A final data recovery report will be prepared after laboratory studies and analyses.

A second type of discovery, an Avoidable New Discovery (AND), will also be described for the Project. The category of AND applies to sites that are identified by the cultural resources monitors during monitoring, but are not in areas of potential direct impact. These ANDs may be an expansion of a previously recorded site or may be an entirely new resource. Please refer to Action Plan Chart 2 in the Appendix for further information.

If the AND is part of a previously recorded site, it will be mapped and described and the boundary of the site will be modified using a DPR Site Record Update. If the increased site size results in the new site boundary encroaching into a project work area or into a portion of the project with the

potential for direct impacts, the first alternative will be to explore establishing or modifying the existing ESA to protect the enlarged area from damage. If impacts to the newly described resource can't be avoided, it will be treated as a UND (Unavoidable New Discovery) and the process described above will be implemented, as appropriate.

Alternatively, if the AND is not within the project work area that is vulnerable to direct ground or project impacts, the data pertaining to the AND will be acquired by the cultural resource monitor and a DPR Site Record or Site Record Update, as appropriate, will be prepared for submission to the South Coastal Information Center. It will also be described and presented in the final monitoring report. If the AND is within 150 ft of the project, an ESA will be established to ensure protection during construction. Avoidable New Discoveries would not require immediate reporting or consultation with the SHPO or other agencies or consulting parties, but will be included as part of the project data record.

3.2 FIELD METHODS

This section describes in more detail the methods used to evaluate unanticipated discoveries identified during construction monitoring that require subsurface excavations. These methods are essentially the same as those used for site-specific evaluations.

Evaluation methods are essentially sampling methods focused on recovering a large enough sample to estimate the density and diversity of the cultural deposit and to expose enough of the site stratigraphy to assess site integrity. A general approach is described below, from surface inspection and collection to various kinds of subsurface investigation.

The first step is to mark all exposed artifacts, artifact concentrations and features with color-coded pin flags to provide an overall view of the site's potential contents. If the unanticipated discovery is a buried site, the area involved will tend to be limited. If the unanticipated discovery's surface material is part of a site that was missed during the original survey, these finds will be sampled with CSCs ranging from 5 x 5 m units to 15 x 15 m units according to surface artifact density. Enough grids will be used to collect from ca. 30 to 50% of all surface artifacts. The CSCs will be supplemented by the collection of all formal tools inside and outside of the CSCs. If practical, all artifacts will be collected on sites with a sparse surface scatter.

Four types of subsurface excavation units will be used.

(1) 30 x 30 or 50 x 50 cm Shovel Test Pits (STPs), excavated in 20-cm levels to depths of no more than 80 cm, usually space at 10-m intervals and/or subjectively placed. These would be used to help define site boundaries, focusing on the edges of the site.

(2) 1.0 x 0.5 m Shovel Test Units (STUs), excavated in 10 or 20-cm levels, to depths between 40 and 100 cm, helping to provide a stratigraphic profile of the deposit. Excavation will cease when two levels of completely sterile soil or subsoil are encountered. The location and number of STUs will vary depending upon the size and artifact density of the deposit, with STUs placed within each discrete site locus, with additional STUs in artifact concentrations.

(3) If an STU yields substantial artifact densities, a 1 x 1 m standard test unit (TU) will be excavated in 10-cm levels adjacent to the STU until sterile soil or bedrock is

reached. Additional TUs may be used if it is judged necessary to properly evaluate the site in terms of its contents and depositional integrity.

(4) Shovel Scrape Units (SSUs), which are rectangular in shape but variable in size depending upon the deposit. Typically SSUs are only 5-10 cm in depth and are placed in areas where the terrain and other data suggest the site deposit is very shallow. These may be used to obtain a representative sample of the shallow areas of the deposit, thereby complementing the results of the STPs, STUs, and TUs.

All excavated material will be screened through 1/8-in (3 mm) wire mesh. Typically most sites range between 0 and 20 cm in depth, below which either decayed bedrock, bedrock or a calcareous B-horizon is typically encountered. When artifacts drop to trace quantities or are absent, either a 50-cm square STP or an auger with a 4-in diameter blade will be used to check for deeper deposits. Sidewall profiles will be drawn and photographed where appropriate, with small soil samples taken for Munsell color and/or constituent classification. All features, except for those containing human remains or burials, will be photographed and drawn carefully in plan view and then bisected to obtain a feature profile which will also be photographed and drawn.

As appropriate, the site will be mapped using either with Trimble sub-meter GPS data receivers with real-time correction capabilities and down to 10 cm accuracy to plot all formed artifacts, surface collection grids (CSCs), excavations units (STPs, STUs, TUs, SSUs), and the boundaries of any defined loci and features. The GPS will also be used to record site boundaries, landform edges, drainages, roads, and other relevant surface features. A series of site overview photographs will be taken to illustrate the site's landscape context and important artifact concentrations, features and artifacts will be photographed as appropriate.

3.3 LABORATORY METHODS

Laboratory work will include standard processing and cataloguing of the materials recovered in the field, and special studies to address the program's research issues.

3.3.1 Standard Processing, Cataloging, and Analysis

Initial lab procedures include cleaning (as appropriate), sorting, and cataloguing of all items. Each item will be individually examined and catalogued according to class, subclass, and material, counted (except for bulk invertebrate and vertebrate remains), and weighed on a digital scale. Very large items, such as oversized ground stone, will be weighed on a dial scale. All coded data will be entered into a MS Excel database.

Cultural material will be sorted during cataloguing into the following categories: 11 classes of prehistoric artifacts, two classes of ecofacts, ethnohistoric items, historic, and modern items, and organic samples. The prehistoric artifact classes included debitage, cores, utilized flakes, retouched flakes, bifaces, percussion tools, ground stone, ceramics, bone artifacts, shell artifacts, and miscellaneous items.

When possible, cores will be separated by platform variability into subclasses such as multidirectional, unidirectional and bifacial types. Debitage, including both flakes and debris, will be sorted by material type and cortical variation (primary, secondary, and interior) during cataloguing. The classification of flaked stone tools will be determined by typology and production

technology. Simple flake tools, i.e., unmodified utilized flakes, will be identified based on the presence of macroscopic use-wear traces. Retouched tools include scrapers, gravers, notched pieces, and other edge modified flakes. Bifaces include projectile points, drills, and standard non-patterned bifaces. Length, width, and thickness measurements will be taken for all tools and cores using a sliding caliper.

Percussion tools, including hammers and abraders, will be defined based on their morphology and the type of macroscopic use-wear they exhibit. Ground stone artifacts will be classified by type, including millingstones and hand stones. Length, width, and thickness measurements will be taken on complete ground stone items.

Organic artifact classes (ecofacts) consisted of vertebrate and bulk shell specimens. After bulk shell is catalogued, it will be sorted to taxon and coded into an Excel sub-catalog. Modified bone and shell artifacts will be separated from the unmodified bone and shell assemblages. Historic resources, as well as modern items, will be catalogued and identified as specifically as is appropriate. Finally, other organic samples will be catalogued by type.

After preliminary cataloguing of the material is completed, more detailed attribute analysis of lithics and groundstone will be performed. Stone artifacts (both flaked and ground) will be individually analyzed for selected morphological and technological attributes, as well as material and condition, in an attempt to gain insight into the period of occupation and range of activities undertaken. Specific analytical methods will be described in the analytical results section. All artifacts, ecofacts, and samples will be subject to appropriate conservation in the field and laboratory including proper packaging and handling.

3.3.2 Special Studies

Special studies to assess a site's research potential and/or to address the research objectives of data recovery programs (as deemed necessary), may include radiocarbon dating, obsidian sourcing, obsidian hydration dating, protein residue analysis, and/or ceramic petrographic analyses.

Radiocarbon Dating

If organic samples are recovered that are appropriate for dating either human activity at the site or natural Holocene depositional events associated with Lake Cahuilla or other landforms, they will be submitted to an appropriate laboratory for radiocarbon measurement. A maximum of four samples may be submitted for evaluation studies.

Obsidian Sourcing and Hydration Analysis

If suitable obsidian artifacts are recovered, samples will be submitted to appropriate laboratories for sourcing and hydration measurement. A maximum of four samples may be submitted for evaluation studies.

Protein Residue Studies

If flaked or ground stone tools that are suitable for protein residue analysis are recovered, samples will be submitted to an appropriate laboratory. A maximum of four samples will be submitted.

Ceramic Petrographic X-Ray Fluorescence (XRF) Studies

A sample of Brownware sherds will be subjected to petrographic analysis or XRF to distinguish sherds produced in the Colorado Desert from sherds produced in the Peninsular Range. A maximum of four samples may be submitted.

3.4 REPORTS

Documentation of sites will comply with the reporting specifications in the BLM 8100 Manual guidance as stipulated in the BLM Cultural Resources Use Permit and Field Authorizations for this Undertaking, and to every reasonable extent with the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as the *California Office of Historic Resource Management Reports (ARMR): Recommended Contents and Format (ARMR Guidelines) for the Preparation and Review of Archaeological Reports.*

All excavation unit and artifact locational information shall be placed in a separate, confidential appendix (or appendices) to the report. Reports shall first be submitted in draft form, in a format as close to the final report as possible, including copies of photographs (as JPEGs), maps, figures, and tables. The BLM and other authorized interested parties will be afforded the opportunity to review the draft report and to access the evaluation data, as needed and when requested. This will be coordinated through the BLM. Based on review comments, the draft report shall be revised and a final report shall be submitted.

3.5 MANAGEMENT AND TREATMENT OF HUMAN REMAINS

Pursuant to the MOA and Native American Graves Protection and Repatriation Act (NAGPRA) Plan of Action, treatment of any bone identified will be reported and a tentative, unofficial assessment of the likelihood of its being human will be established. If the bone is determined to be human by the Principal Investigator, the PI will notify the appropriate BLM staff and will also be responsible for notifying the County of Imperial Office of the Coroner. The Coroner will in turn notify the Native American Heritage Commission.. All remains will be left in place and protected until they can be examined by the Medical Examiner and jurisdiction is determined.

As stipulated in the MOA in Stipulation VI(a&b), the BLM will ensure that any Native American human remains, sacred objects, or items of Native American cultural patrimony are encountered on BLM administered lands during the implementations of this Management Plan will be treated in accordance with the requirements of the NAGPRA (Pub. L. 101-601). The BLM will also ensure that Native American burials and related cultural items on non-federal lands are treated in accordance with the applicable requirements of the California Public Resources Code in Sections 5097.98 and 5097.991, and of the California Health and Human Safety Code in Section 7050.5(c). All NAGPRA consultation will be carried out by the BLM. Immediate telephone notification will be made to the appropriate agency officials, followed by written confirmation.

3.6 CURATION

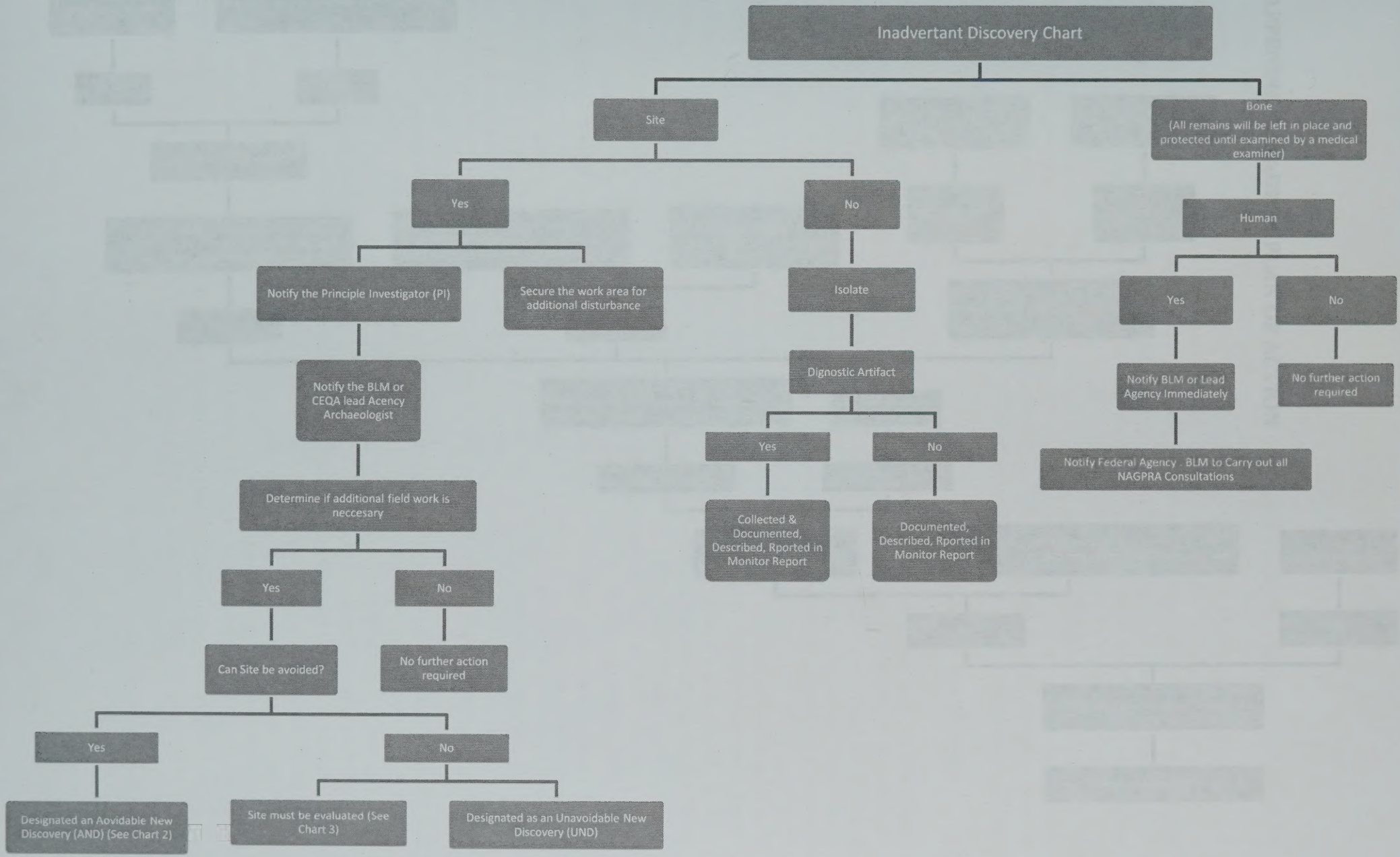
Prior to commencement of construction, Ocotillo Express LLC will establish a curation agreement for the permanent curation of all cultural resources collected during archaeological work associated with the Ocotillo Wind Energy Project, preferably with the Imperial Valley Desert Museum or a recognized curation facility.

4. SUMMARY

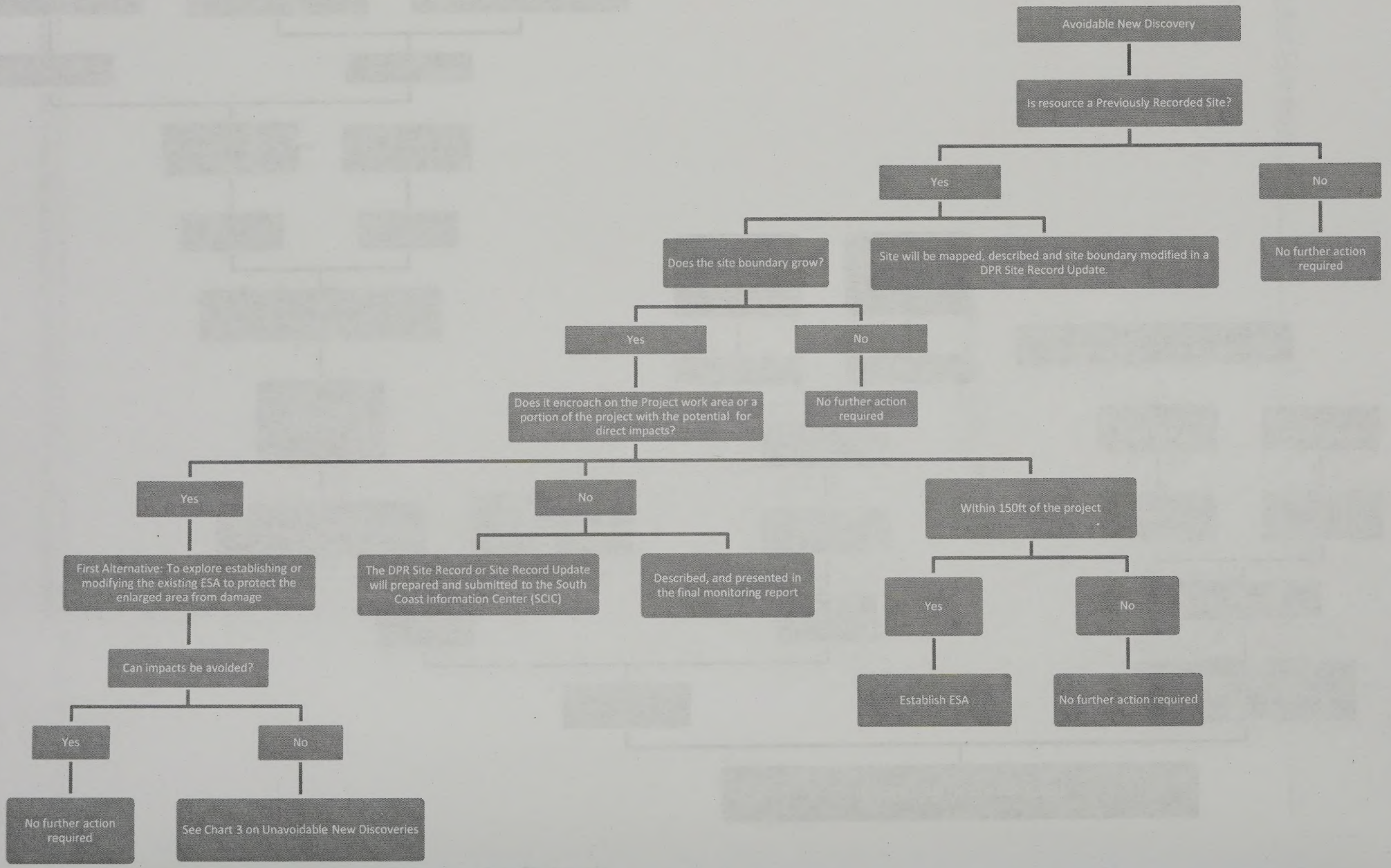
This management plan describes the protocol for construction monitoring of cultural resources and the treatment of unanticipated archaeological discoveries. Qualified archaeological monitors will be present to observe all ground breaking activity near archaeological sites to ensure adherence to Environmentally Sensitive Areas (ESAs). Exclusionary fencing will be used to protect sites that have construction activity within or near ESA's. All construction personnel will receive cultural resources training to ensure awareness of the archeological sensitivity of the Project area, and especially for ESAs. Unanticipated discoveries will undergo formal archaeological evaluation to determine the extent and character of newly identified cultural deposits for the purposes of supporting recommendations of NRHP or CRHR eligibility. The same evaluation methods can be used for the data recovery of the discovery, if it cannot be avoided.

Action Plan Charts

Action Plan Chart 1 – Inadvertent Discovery Chart



Action Plan Chart 2 – Avoidable New Discovery (AND)



APPENDIX G: NAGPRA PLAN OF ACTION

NAGPRA PLAN OF ACTION

1 INTRODUCTION

Stipulation VI of the Memorandum of Agreement (MOA) stipulates that a Plan of Action (POA) is to be implemented if human remains are discovered within the APE, and that the POA will address the roles of the MOA Signatories, Tribes, and Invited Signatories.

While the steps to be taken in the event of any discovery within the APE are described in Appendix F (Discovery Plan), the procedures specifically related to the discovery of human remains, funerary objects, sacred objects, and objects of cultural patrimony are detailed in the present appendix.

2 APPLICABLE LAWS

Depending on land ownership and other factors, either Federal law or State law, or both, will apply to any human remains, funerary objects, sacred objects, or objects of cultural patrimony that may be discovered within the APE. Federal statutes, most notably ARPA and NAGPRA govern discoveries on Federal or Tribal land. State laws, prominently H&SC 7050.5(b) and PRC 5097.98(a-b) in California govern discoveries on non-Federal/non-Tribal land.

This POA complies with the NAGPRA regulations, which state that the Federal Agency official "must complete a written Plan of Action (described in [43 CFR] § 10.5(e)) and execute the actions called for in it" (43 CFR 10.3(c)(2)). The regulations also specify that a copy of the POA must be provided to the involved lineal descendants and Indian tribes, and that such descendants and tribes may sign the POA (43 CFR 10.5(e)). Moreover, the regulations require the POA to comply with 43 CFR 10.3(b)(1), which speaks to responsibilities under ARPA, and to address and document nine topics (see 43 CFR 10.5(e)(1-9) related to the discovery and treatment of human remains and cultural items as defined at 43 CFR 10(2)(d). These nine topics are taken up in Subsections 3- 9, below.

3 PLAN OF ACTION

3.1 Cultural Items

The Ocotillo Express Wind Energy Project is a Federal undertaking that encompasses both public and private land. The POA provides specific direction for how the El Centro Field Office of the Bureau of Land Management (BLM), Tribes, and Invited Signatories will comply with legal requirements governing treatment and custody of human remains for the Undertaking. This POA is meant to address the requirements of the Native American Graves Protection and Repatriation Act (NAGPRA) as well as state-specific statutes concerning human remains. As lead Federal Agency for cultural resources compliance for this Undertaking, the BLM is the primary contact and executor for the POA.

According to NAGPRA and implementing regulations, a POA must identify "the kinds of objects to be considered 'cultural items' as defined in [43 CFR] § 10.2(d)" (43 CFR 10.5(e)(1)).

In this POA, human remains and three types of Native American cultural items are recognized: (1) "funerary objects," including both "associated funerary objects" and "unassociated funerary objects"; (2) "sacred objects"; and (3)"objects of cultural patrimony." The full definitions of these terms, as set forth in the NAGPRA regulations (43 CFR 10.2(d)(1-4)), are incorporated herein by reference and adopted for use throughout this POA. Also for the purposes of this POA, the term "grave goods," as used in California law (e.g., in PRC 5097.98), is deemed to be subsumed by the Federal term "funerary objects." More generally, the term "cultural items," as used in this POA, includes funerary objects, sacred objects, and objects of cultural patrimony.

3.2 Custody

The POA is to present "the specific information used to determine custody pursuant to [43 CFR] § 10.6" (43 CFR 10.5(e)(2)).

3.2.1 Federal Land

In the event of any discovery of human remains and/or funerary objects on Federal land within the APE, custody (i.e., ownership or control per 43 CFR 10.6(a)) shall vest in the lineal descendant of the deceased individual (per 43 CFR 10.6(a)(1)), or, "in cases where a lineal descendant cannot be ascertained and no claim is made, and with respect to unassociated funerary objects, sacred objects, and objects of cultural patrimony," in the Indian tribe identified in accordance with the priority and criteria set forth at 43 CFR 10.6(a)(2). BLM is responsible for ensuring that the custody of any human remains and/or funerary objects discovered within the APE of the Project is established in accordance with these regulations. Additionally, prior to the transfer of custody of the remains and/or objects to the lineal descendant or Indian tribe, BLM must publish general notices of the proposed disposition in accordance 43 CFR 10.6(c) (see also Subsection 3.9.1, below).

3.2.2 Non-Federal/Non-Tribal Land

The custody of human remains discovered on non-Federal/non-Tribal lands is a complex matter and ultimately, after prescribed consultation with the Native American individual or group identified by the NAHC as the Most Likely Descendant (MLD), lies with the land owner. Relevant procedures and responsibilities are set forth at PRC 5097.98(a-b, e-f) and summarized in Subsection 3.3 of this POA.

G.3.3 Treatment, Care, and Handling

The NAGPRA regulations require the POA to address "the planned treatment, care, and handling of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered" (43 CFR 10.5(e)(3)).

In the event that human remains are discovered within the APE, either inadvertently or in the course of archaeological investigations, and without respect to land ownership, the Ocotillo Express LLC Project Manager will:

(1) Immediately cease or cause to be ceased any earth-disturbing activity within an area extending not less than 5 and not more than 50 meters (to be determined in the field

on a case-by-case basis by the lead archaeological monitor) from the discovered remains;

(2) Take whatever feasible steps may be needed to ensure that the subject remains are not disturbed further and are secure pending implementation of the treatment measures prescribed in this POA;

(3) Ensure that the remains are treated with appropriate respect and cultural sensitivity at all times;

(4) Within 24 hours, contact both the El Centro BLM Project Manager and the El Centro BLM Archaeologist to report the discovery; and

(5) Cooperate fully with the parties responsible for carrying out the treatment measures described in Subsections 3.3.1- 3.3.3, below.

3.3.1 Discoveries on Federal Land

If human remains or funerary objects are discovered on Federal lands, all activity in the area of the discovery will cease immediately. The Ocotillo Express LLC Project Manager will notify both the El Centro BLM Project Manager and the El Centro BLM Archaeologist by telephone within 24 hours of the discovery, followed within three days by written confirmation. The BLM will then be responsible for notifying the appropriate Tribe(s), and for initiating Tribal consultation as prescribed by 43 CFR 10.5. The Ocotillo Express LLC Project Manager will also notify the appropriate county coroner who, pursuant to H&SC 7050.5 et seq. and PRC 5097.98, will determine whether the remains are those of a Native American; if so, the coroner will contact the NAHC, and the procedures set forth at PRC 5098.98 will be implemented together with the Federal procedures required by 43 CFR 10.3-10.6.

BLM will ensure that the stipulations of this POA are fully implemented before authorizing Ocotillo Express LLC to continue any ground-disturbing activity. Such activity will be suspended in the discovery area (i.e., within not less than 5 nor more than 50 meters in all directions from the discovered remains and/or objects) until authorized by BLM to resume such activities. Such activity will be suspended in the discovery area until the Tribes, Ocotillo Express LLC, and BLM can resolve treatment in this manner, then BLM shall consult with the CA SHPO to develop a treatment plan within 15 days of notification of discovery. Preservation and protection in place shall be the preferred treatment measure. Absent objection by the SHPO, BLM will then implement the treatment plan, or, if the SHPO objects, BLM will utilize the dispute resolution process set forth in Stipulation XI of the MOA to resolve any objection. Human remains and any funerary objects will not be excavated or otherwise removed unless approved by BLM and after consultation with the Tribes as appropriate. Disposition of any such remains discovered on or removed from Federal or Tribal lands will follow the protocols discussed in Subsection 3.9, below.

3.3.2 Discoveries on Non-Federal/Non-Tribal Land

When human remains and/or "grave goods" (i.e., funerary objects) are discovered on non-Federal/non-Tribal land other than a dedicated cemetery in California, the party responsible for

the discovery must notify the county coroner. If such remains and/or grave goods are found within the APE of the Project, Ocotillo Express LLC will notify the BLM and the Imperial County coroner. After notification, BLM will be responsible for notifying appropriate Signatories, Invited Signatories, and Tribes.

The coroner will determine whether or not the circumstances, manner, and cause of death require further investigation. If the coroner determines that the remains are Native American, the coroner will contact the Native American Heritage Commission (CH&SC 7050.5(b)). The NAHC will then immediately identify those persons it believes to be to be most likely descended from the deceased Native American. With the permission of the landowner, the MLD may inspect the site of the discovery and recommend means for treating or disposing, with appropriate dignity, the human remains and any associated grave goods. The MLD will complete the inspection and make a recommendation within 48 hours of being granted access to the site. If the NAHC is unable to identify a MLD, or if the MLD fails to make a recommendation, or if the landowner rejects the MLD's recommendation and mediation by the NAHC fails to provide measures acceptable to the landowner, the landowner will reinter the human remains and associated items with appropriate dignity on the property in a location not subject to further subsurface disturbance (PRC 5097.98).

3.4 Archaeological Recording

Also to be discussed in the POA is "the planned archaeological recording of the human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered" (43 CFR 10.5(e)(4)).

Following the initial discovery and identification of any human remains, funerary objects, sacred objects, or objects of cultural patrimony within the APE, no further archaeological excavation or recording of such remains and/or objects will occur until after either (1) the lineal descendant or Tribe entitled to custody pursuant to 43 CFR 10.6(a), if the discovery is on Federal or Tribal land, or (2) the MLD identified pursuant to PRC 5097.98, if the discovery is on non-Federal or non-Tribal land in California, or (3) "the group with cultural affinity" has made a recommendation to BLM and the landowner with respect to the disposition of the remains and/or objects.

Thereafter, BLM will take into account the recommendation(s) of the appropriate Native American lineal descendant or Tribe, or MLD, or group with cultural affinity and will decide on the nature of any archaeological excavation or recording to be done of the discovered remains and/or funerary objects.

3.5 Analysis

The regulations also call for the POA to identify "the kinds of analysis planned for each kind of object" (43 CFR 10.5(e)(5)).

No scientific analysis of human remains and/or funerary objects will occur until after either (1) the lineal descendant or Tribe entitled to custody pursuant to 43 CFR 10.6(a), if the discovery is on Federal or Tribal land, or (2) the MLD identified pursuant to PRC 5097.98, if the discovery is on non-Federal or non-Tribal land in California, or (3) "the group with cultural affinity" has made a recommendation to BLM and the landowner with respect to the disposition of the

remains and/or objects, including whether or not destructive and/or nondestructive analysis should be permitted.

Thereafter, BLM will take into account the recommendation(s) of the appropriate Native American lineal descendant or Tribe, or MLD, or group with cultural affinity and will decide on the nature of any scientific analysis is to be done of the discovered remains and/or funerary objects.

3.6 Tribal Contacts

Another important feature of the POA is that it must state "any steps to be followed to contact Indian tribe officials at the time of intentional excavation or inadvertent discovery of specific human remains, funerary objects, sacred objects, or objects of cultural patrimony" (43 CFR 10.5(e)(6)). As discussed in the MOA, BLM has invited fourteen Indian tribes (the Tribes) and one non-federally recognized tribe to participate in the Section 106 consultation process and to be Concurring Parties to the MOA. The Tribes, non-federally recognized tribe and one Tribal Organization are listed below together with specifications as to how each wishes to be contacted and involved if human remains are discovered within the APE.

In the event that human remains and/or funerary objects, or sacred objects, or objects of cultural patrimony are discovered within the APE, either inadvertently or in the course of intentional archaeological excavations, Ocotillo Express LLC will immediately (1) cease or cause to be ceased any earth-disturbing activity within an area extending not less than 5 meters and not more than 50 meters (to be determined in the field on a case-by-case basis) from the discovered remains; (2) ensure that the remains and/or cultural objects are protected from further disturbance; and (3) inform BLM by telephone within 24 hours following the discovery. BLM will then contact the appropriate Tribes, Tribal Organizations, Signatories, and Invited Signatories. The Tribes will be contacted and consulted in accordance with the information provided below, including the designated Point of Contact (POC) for each Tribe or Tribal Organization, and in other sections of this POA.

BARONA BAND OF DIEGUENO INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

CAMPO BAND OF MISSION INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

COCOPAH INDIAN TRIBE

POC Contact Information
How the Tribe Wishes to Be Involved

EWIIAAPAAYP BAND OF KUMEYAAY INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

FORT YUMA QUECHAN INDIAN TRIBE

POC Contact Information
How the Tribe Wishes to Be Involved

JAMAL INDIAN VILLAGE

POC Contact Information
How the Tribe Wishes to Be Involved

KWAAYMII LAGUNA BAND OF INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

KUMEYAAY CULTURAL REPATRIATION COMMITTEE

POC Contact Information
How the Organization Wishes to Be Involved

LA PSOTA BAND OF KUMEYAAY INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

MANZANITA BAND OF KUMEYAAY INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

MESA GRANDE BAND OF MISSION INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

SAN PASQUAL BAND OF DIEGUENO INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

SANTA YSABEL BAND OF DIEGUENO INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

SYCUAN BAND OF KUMEYAAY NATION

POC Contact Information
How the Tribe Wishes to Be Involved

TORRES-MARTINEZ DESERT CAHUILLA INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

VIEJAS BAND OF KUMEYAAY INDIANS

POC Contact Information
How the Tribe Wishes to Be Involved

3.7 Traditional Treatment Measures

As stipulated in the NAGPRA regulations (43 CFR 10.5(e)(7)), the POA must describe "the kind of traditional treatment, if any, to be afforded the human remains, funerary objects, sacred objects, or objects of cultural patrimony by members of the Indian tribe...."

Following any discovery of Native American human remains and/or funerary objects, and prior to the disposition of such remains and/or objects, BLM will consult with the appropriate Native American lineal descendant or Tribe, or MLD, or group with cultural affinity, and will ascertain the wishes of such lineal descendant or Tribe, or MLD, or group with cultural affinity with respect to the kind of traditional treatment, if any, to be afforded the human remains or objects. BLM will then take the necessary steps to ensure that the lineal descendant or Tribe, or MLD, or group with cultural affinity is granted the opportunity, access, and privacy required for the traditional treatment of the remains and/or objects in compliance with NAGPRA, AIRFA, and all other applicable statutes and regulations.

3.8 Reporting

The POA also must address "the nature of reports to be prepared" (43 CFR 10.5(e)(8)). Although it is difficult to suggest the nature of reports to be prepared without knowing the kinds of remains and/or objects that would be discovered, or whether the discovery would be made inadvertently or in the course of planned and permitted archaeological excavations, one can define the procedures to be followed with respect to deciding on the scope, content, distribution, and confidentiality of any reports that may be produced.

Decisions about report preparation and content will be based on a consultative process very similar to what is described for scientific analysis (see Subsection 3.5, above). No reports of human remains and/or funerary objects will be released until after either (1) the lineal descendant or Tribe entitled to custody pursuant to 43 CFR 10.6(a), if the discovery is on Federal land, or (2) the MLD identified pursuant to PRC 5097.98, if the discovery is on non-Federal or non-Tribal land in California, or (3) "the group with cultural affinity" has made a recommendation to BLM and the landowner with respect to the disposition of the remains and/or objects, including whether or not archaeological reporting should take place.

Thereafter, BLM will take into account the recommendation(s) of the appropriate Native American lineal descendant or Tribe, or MLD, or group with cultural affinity and will decide on the nature of any archaeological report to be prepared on the discovered remains and/or funerary objects. BLM also will ascertain whether or not photographs of the subject remains and/or objects are culturally permissible, who (i.e., which agencies, Tribes, institutions, etc.) should receive copies of any report that is produced, and how best to maintain the confidentiality of such report and the information therein to comply with ARPA, NAGPRA, and other laws.

3.9 Disposition of Remains and Objects

Finally, the NAGPRA regulations require the POA to set forth a plan for "the disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony following [43 CFR] § 10.6" (43 CFR 10.5(e)(9)). The procedures to be followed in arriving at decisions regarding disposition depend upon land ownership in which the remains and/or objects are found. In addition, the final disposition or custody of human remains, funerary objects, sacred objects, or objects of cultural patrimony is also subject to consultation with the parties having claim(s) to the remains and materials in question. During consultation the remains and/or objects shall be treated respectfully and stored in a secure location.

3.9.1 Discoveries on Federal Land

In the event that human remains and/or cultural items are found within the APE of the Project on Federal lands, preservation and protection in place shall be the primary treatment strategy. Should preservation and protection in place not be possible, following consultation as required by 43 CFR 10.6, the BLM will ascertain custody in accordance with 43 CFR 10.6(a–c) (see Subsection C.3.2 of this POA). Once BLM has made a determination of the party entitled to custody, BLM will publish at least two notices of the proposed disposition of the remains and/or objects, as required by 43 CFR 10.6(c). These notices must be published at least one week apart. If no additional claimants come forward within 30 days following the second publication of the notice, then BLM will transfer custody of the remains and/or cultural items to the party named in the notices pursuant to 43 CFR 10.6(c). The party having custody will then decide on the ultimate disposition of the remains and/or cultural items. If the party given custody should decide that any of the remains and/or items are to be curated, then they will select for that purpose and deliver such remains and/or items to a repository that meets the standards and criteria set forth at 36 CFR 79.

3.9.2 Discoveries on Non-Federal/Non-Tribal Land

If Native American human remains and/or grave goods are found within that portion of the APE—and after Ocotillo Express LLC has notified the BLM and the Imperial County coroner, and the coroner has contacted the NAHC, and the NAHC has designated a MLD, and the MLD has visited the discovery site, pursuant to CH&SC 7050.5 *et seq.* and PRC 5097.98(a-b)—the landowner will discuss and confer with the MLD "all reasonable options" regarding the MLD's preferences for treatment of the human remains and/or grave goods. These options may include:

A. Preservation of Native American human remains and associated items in place.

B. The nondestructive removal and analysis of human remains and items associated with Native American human remains.Relinquishment of Native American human remains and associated items to the descendants for treatment.

C. Other culturally appropriate treatment [PRC 5097.98(b)(1)(A-D)].

The landowner may accept the MLD's recommendation, or agree to extend discussions taking into account the possibility that additional or multiple Native American human remains may be present, or reject the MLD's recommendation. If the NAHC is unable to identify an MLD, or the MLD does not make a recommendation, or if the landowner rejects the MLD's recommendation, and if mediation (as provided for by PRC 5097.98(k)), if invoked, fails to provide measures acceptable to the landowner,

> the landowner or his or her authorized representative shall inter the human remains and items associated with Native American remains with appropriate dignity on the property in a location not subject to further and future subsurface disturbance. To protect these sites, that landowner shall do one or more of the following:
>
> 1. Record the site with the commission [i.e., the NAHC] or the appropriate Information Center [of the California Historical Resources Information System (CHRIS)].
>
> 2. Utilize an open-space or conservation zoning designation or easement.
>
> 3. Record a document with the county in which the property is located [PRC 5097.98(e)(1-3)].

In these circumstances, it is the landowner who, after the prescribed consultation, makes the final decision regarding the disposition of Native American human remains and/or grave goods governed by PRC 5097.98. The Undertaking, however, remains under Federal jurisdiction, so these restrictions of California law may only take effect after pertinent Federal requirements are complied with.

4 SUMMARY OF THE POA

In summary, in the event that human remains and/or funerary objects are found within the APE of the Undertaking, the Plan of Action (POA) to be implemented includes;

(1) BLM will be the lead Federal Agency responsible for seeing that the terms of the POA are executed and that the Undertaking is in compliance with NAGPRA, and other applicable Federal statutes and regulations.

(2) BLM will maintain ongoing consultation, as necessary and appropriate, with the PA Signatories, Invited Signatories, and Tribes, and specifically will involve the Tribes in decision making with respect to any human remains and/or cultural items that may be discovered within the APE, in accordance with 43 CFR 10.

(3) Ocotillo Express LLC will summarize in construction and maintenance contracts all relevant legal requirements regarding the discovery and

treatment of human remains and/or funerary objects, and will take appropriate steps to ensure that its contractors and employees are familiar with the required procedures.

(4) In the event that human remains and/or funerary objects are found within the APE of the Project, Ocotillo Express LLC will immediately cease or cause to be ceased any activity within an area extending not less than 5 meters and not more than 50 meters (to be determined in the field on a case-by-case basis) from the discovered remains;

(5) If human remains or funerary objects are discovered on Federal land, Ocotillo Express LLC will notify BLM by telephone as soon as possible, but no later than 24 hours after the discovery, followed within three business days by written confirmation. BLM will then be responsible for notifying the appropriate Tribe(s), and for initiating Tribal consultation as prescribed by 43 CFR 10.5. The Ocotillo Express Project Manager will also ensure that the Imperial County coroner is notified, pursuant to H&SC 7050.5 *et seq.* The telephone number of the coroner's main office in Imperial County is 760-339-6301. BLM's El Centro Field Office main number is 760-337-4400. Ocotillo Express LLC can be reached at XXX-XXX-XXXX.

(6) The BLM in coordination with the Imperial County coroner will make a determination as to whether the remains are human, or non-human. This determination will be made by qualified personnel, such as a physical or forensic anthropologist (in conjunction with a cultural resources contractor, if one is involved with the discovery). If the remains are identified as non-human, no further notification or action is required, although further archaeological assessment may be needed. If the remains are human, additional measures and procedures, as described below, apply.

(7) Ocotillo Express LLC, under the direction of BLM will take whatever steps may be needed to ensure that the subject remains and or/funerary objects are not disturbed further and are secure pending further implementation of the treatment measures as prescribed in the POA. BLM, in coordination with Ocotillo Express LLC, will ensure that the remains and/or objects are treated with appropriate respect and cultural sensitivity at all times.

(8) In the event of an inadvertent discovery of human remains on Federal lands, any potentially disturbing activity will be suspended in the discovery area (i.e., within not less than 5 nor more than 50 meters in all directions from the discovered remains and/or objects) until authorized by BLM to resume such activities. BLM will ensure that the stipulations of this POA are fully implemented. Such activity will be suspended in the discovery area until the Tribes, Ocotillo Express LLC, and BLM can

determine if preservation and protection in place or other treatment is necessary. If preservation in place is not possible, the BLM shall consult with the SHPO to develop a treatment plan within 15 days of notification of discovery. Absent objection by the SHPO, BLM will then implement the treatment plan, or, if the SHPO objects, BLM will utilize the dispute resolution process set forth in Stipulation XI of the MOA to resolve any objection.

(9) Human remains and/or funerary objects discovered on Federal land will not be excavated or otherwise removed unless approved by BLM and after consultation with the Tribe(s) and BLM, as appropriate. Disposition of any such remains and/or objects discovered on or removed from Federal lands will follow the protocols discussed in POA Subsection 3.9.

(10) The Imperial County coroner will determine whether or not the circumstances, manner, and cause of death require further investigation as a crime scene. If not, the coroner will endeavor to determine if the remains are those of a Native American. This will be accomplished in consultation with a physical anthropologist, human osteologist, or other qualified specialist to verify that the remains are human and, if so, whether or not they appear to be those of a Native American. This aspect of the work will be coordinated very closely with the coroner, as required by law, to ensure that any potential evidence of a crime is not disturbed.

(11) If the coroner determines that the remains are Native American and not related to a crime, the coroner will contact the Native American Heritage Commission [per CH&SC 7050.5(b)]. The NAHC will then immediately identify those persons it believes to be to be most likely descended from the deceased Native American. With the permission of the landowner, the MLD may inspect the site of the discovery and recommend means for treating or disposing, with appropriate dignity, the human remains and any associated grave goods. The MLD will complete the inspection and make a recommendation within 48 hours following notification by the NAHC. If the NAHC is unable to identify an MLD, or if the MLD fails to make a recommendation, or if the landowner rejects the MLD's recommendation and mediation by the NAHC fails to provide measures acceptable to the landowner, the landowner will reinter the human remains and any associated items with appropriate dignity on the property in a location not subject to further subsurface disturbance, given the restrictions addressed in Item 16 (below), and subject to any additional compliance measures that address human remains within the APE of the Undertaking [PRC 5097.98].

(12) Regardless of the discovery site's ownership status (Federal or private), if the human remains are not those of a Native American, then BLM and the

landowner, if the discovery site is not on Federal land, will consult with the coroner, a biological anthropologist or human osteologist, and a qualified historical archaeologist to develop an appropriate plan for treatment. BLM will consult with the SHPO and other concerned parties to determine if historical research, further archaeological excavations, and/or other studies may be necessary before a treatment plan can be finalized. Also, if the remains are those of an identifiable individual and not part of a crime scene, BLM will notify the next of kin. Such kin may wish to influence or control the subsequent disposition of the remains.

(13) If the next of kin (for non-Indian remains), MLD, or other appropriate Native American entity (e.g., culturally affiliated tribe, indigenous tribe, other tribe likely to have a cultural relationship, or lineal descendants) so requests, BLM will coordinate discussion between concerned parties to determine if reburial at or near the original site in a location not subject to further disturbance is feasible. If a proximate reburial location is not feasible, then BLM may continue to coordinate discussions until a final disposition of the remains is decided upon

(14) Following the initial discovery and identification of any human remains, funerary objects, sacred objects, or objects of cultural patrimony within the APE, no further archaeological excavation, recording, or analysis, of such remains and/or objects will occur until after (1) the lineal descendant or Tribe entitled to custody pursuant to 43 CFR 10.6(a), if the discovery is on Federal or Tribal land, or (2) the MLD identified pursuant to PRC 5097.98, if the discovery is on non-Federal land in California, or (3) "the group with cultural affinity has made a recommendation to BLM and the landowner with respect to the disposition of the remains and/or objects. Thereafter, BLM will take into account the recommendation of the appropriate Native American lineal descendant or Tribe, or MLD, or group with cultural affinity and will decide on the nature of any archaeological excavation, recording, or analysis, to be done of the discovered remains and/or funerary objects.

Following any discovery of Native American human remains and/or funerary objects, and prior to the disposition of such remains and/or objects, BLM will consult with the appropriate Native American lineal descendant or Tribe, or MLD, or group with cultural affinity, and will ascertain the wishes of such lineal descendant or Tribe, or MLD, or group with cultural affinity with respect to the kind of traditional treatment, if any, to be afforded the human remains or objects. BLM, will then take the necessary steps to ensure that the lineal descendant or Tribe, or MLD, or group with cultural affinity is granted the opportunity, access, and privacy required for the traditional treatment of the remains and/or objects in compliance with NAGPRA, AIRFA, and all other applicable statutes and regulations.